OCT 17 1949

CANADIAN GEOGRAPHICAL JOURNAL

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

OCTOBER 1949



If you're interested in facts about oil...

A country's consumption of oil and its standard of living are closely linked. The higher the standard of living, the higher the consumption of oil is likely to be.

Consumption of oil in Canada is the second highest in the world on a per capita basis. United States alone is higher.

Canadians are using twice as much oil as in 1939 and more than three times as much as in 1932.

At the beginning of 1949 Canada was importing 84% of her oil.

During 1948 Imperial Oil drilled a total of 138 wells in its search for oil in Alberta and in developing the province's new fields.

During 1949 the oil industry is spending at the rate of roughly $2,000,000 a week in exploration and development in Alberta.

Early in 1949 known oil reserves in Canada were roughly equal to our needs for the next five years, but this oil could not be produced efficiently in less than 20 years.

To meet present requirements in petroleum it has been estimated Canada needs reserves of three to five billion barrels of oil.

Since 1939 the general wholesale price index has advanced more than 100% whereas the petroleum products price index has advanced only 62%.

BRINGING YOU OIL IS A BIG JOB
. . . AND A COSTLY ONE

IMPERIAL ESSO PRODUCTS

IMPERIAL OIL LIMITED

CANADIAN GEOGRAPHICAL JOURNAL

Published monthly by

THE CANADIAN GEOGRAPHICAL SOCIETY

36 Elgin Street, Ottawa

Editor - GORDON M. DALLYN— Assistant Editor - MALVINA BOLUS

This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustrations, of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth and other parts of the world in which Canada has special interest.

The articles in this Journal are indexed in the *Canadian Periodical Index* which may be found in any public library.

The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1936.

Address all communications regarding change of address, non-delivery of Journal, etc., to the publication office, 1,000 St. Antoine St., Montreal, Canada, giving old and new address. On all new memberships, the expiry date will be printed on wrapper containing starting number. This will constitute a receipt for subscription.

Membership dues of The Canadian Geographical Society, which include postpaid delivery of the Journal, are $4.00 per year in any country, payable at par in Ottawa.

Member Audit Bureau of Circulations

SPECIAL REPRESENTATIVES:

Ontario and Quebec: F. A. DALLYN

Toronto office — 21 King Street, E. (Tel. EL. 2863)

Montreal office — 1,000 St. Antoine Street. (Tel. LA. 5566)

Europe: S/L W. H. CORKILL, M.B.E. The Mead, West Dumpton Lane, Ramsgate, Kent, England.

CONTENTS

OCTOBER, 1949 ✦ VOLUME XXXIX ✦ NUMBER 4

COVER SUBJECT:—*Eskimo girls of Canada's Eastern Arctic in the region west of Hudson Bay.*

Page

OIL FROM THE EARTH 134
by E. M. HOLBROOK

THE BRIDGE OF THE GIANTS 154
by HARRIET GEITHMANN

RECENT DEVELOPMENTS IN THE CANADIAN NORTH 156
by H. L. KEENLEYSIDE

CANALS IN CRADLE AND GRAVE 177
by VINTON MADER

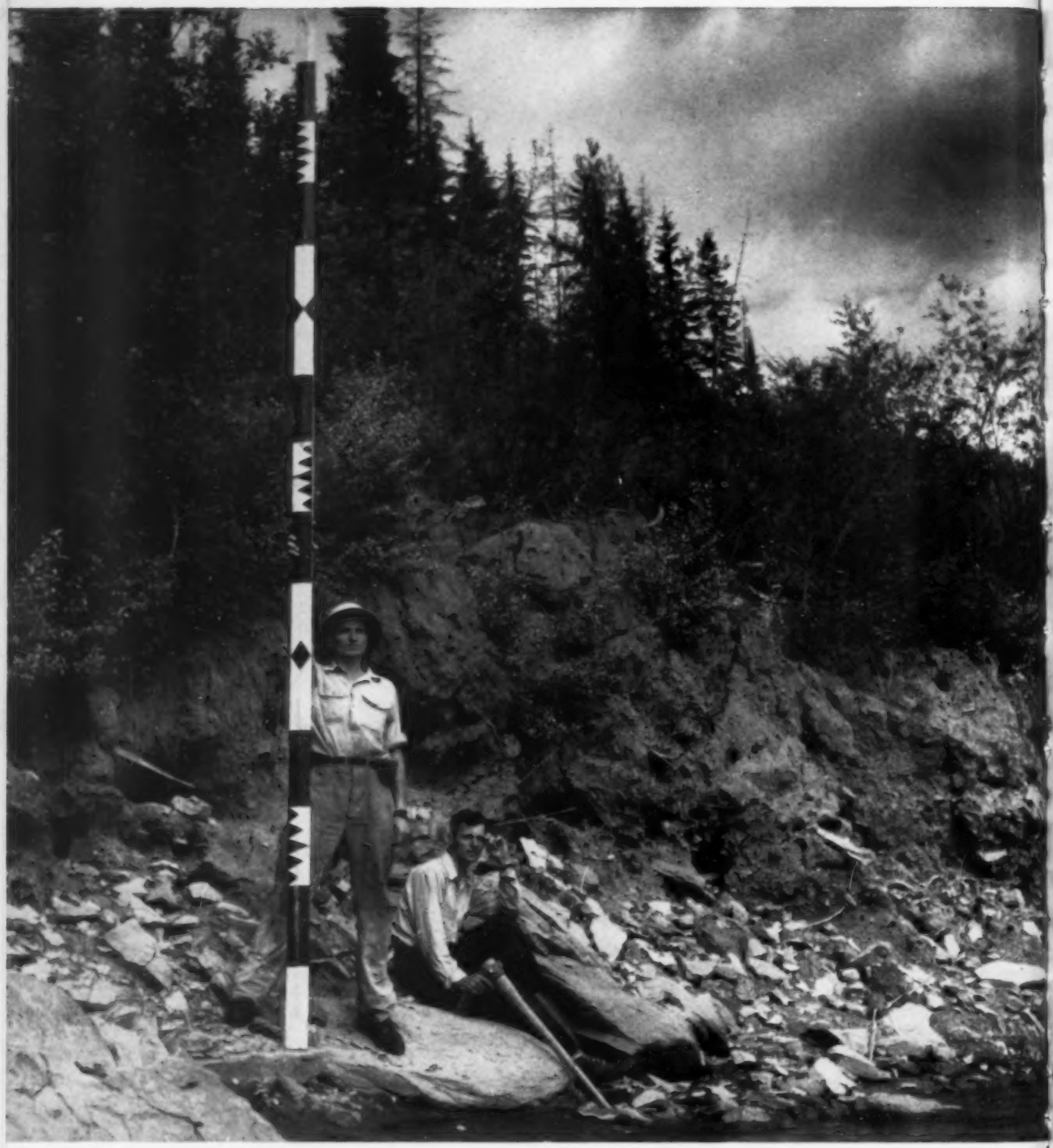
EDITOR'S NOTE-BOOK VII

✦

CONTENTS OF THIS JOURNAL ARE COPYRIGHT

AUTHORIZED AS SECOND CLASS MAIL, POST OFFICE DEPARTMENT, OTTAWA

PRINTED IN CANADA



Search for oil in the Alberta foothills of the Rocky Mountains. The contours of rock formations which crop out at the surface along streams are important to geologists seeking structures which may hold oil. Here a survey rod is held so that a rock outcrop can be mapped.

Oil From The Earth

by E. M. HOLBROOK

WHAT SUBSTANCE in the world is most useful to man? Which portion of Nature's generous bounty is of the greatest benefit in civilization's constant struggle for progress? Perhaps it is water or wood, you say. Or is it perhaps iron, or gold, or uranium?

A case could be made for any of those and for many others but this is the story of petroleum, a product of the earth that has so many thousands of uses that it can hardly avoid being called man's most versatile servant. Commonly this servant is known as "oil"; its correct name, petroleum, comes from Latin roots and means "rock oil".

Oil is older than the human race but its widespread, practical use has come about only within the lifetime of living men. To our earliest ancestors it was a mysterious, greasy, sticky liquid that bubbled to the earth's surface in a few places and was useful only because they found good hunting near the oil springs where wild animals came to rid themselves of skin pests.

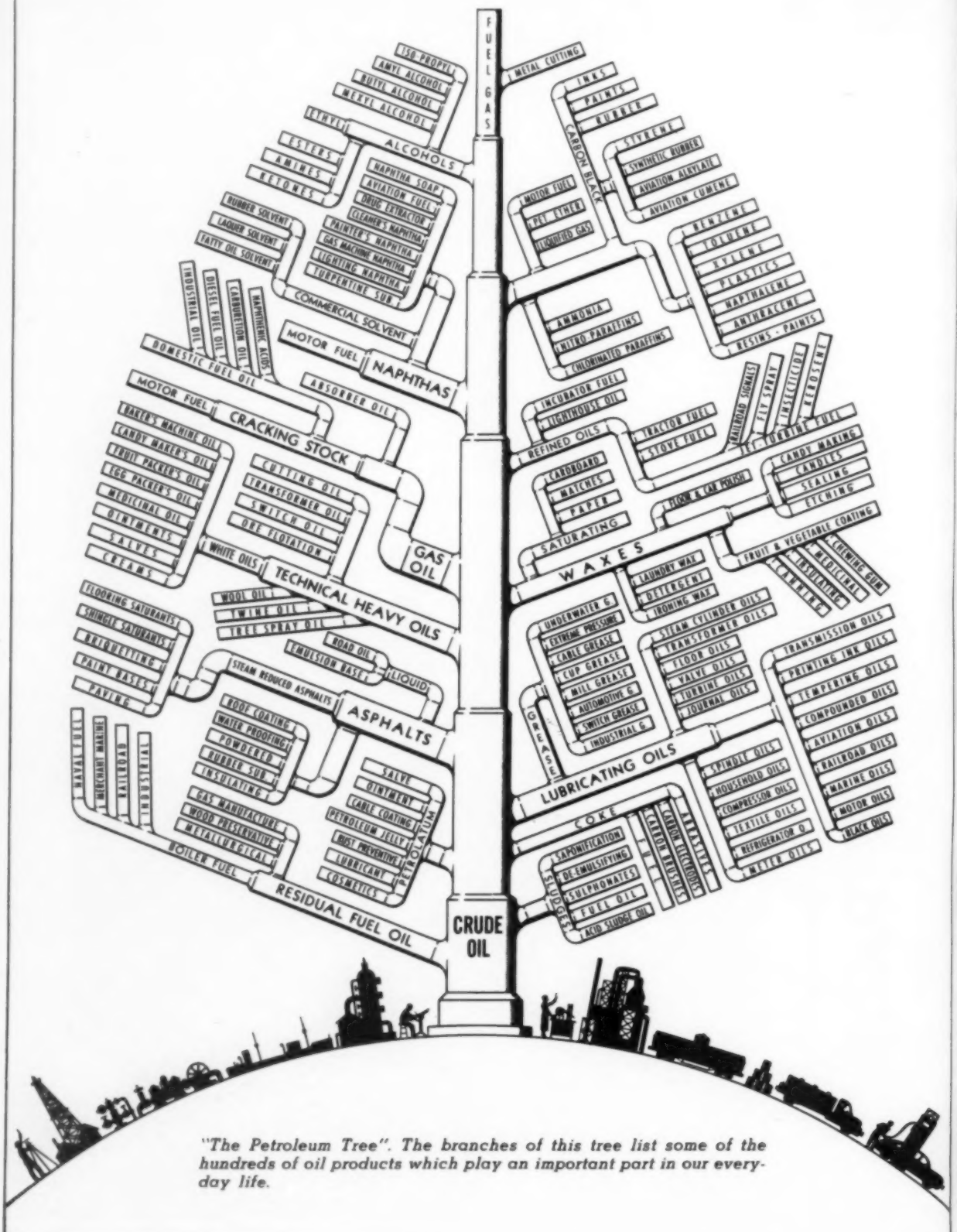
In more recent times the tent-show medicine man collected petroleum where it showed itself above ground, bottled the evil-tasting stuff and sold it as a remedy for everything from bots to bites. Until less than a century ago the only sources of oil in North America were seepage pools on the surface. Then came a series of events that started a real search for oil, a search that, far from being satisfied, continues today with increased vigour and determination.

The first thing that happened was that people began to realize that the sperm whale, source of almost all lamp fuel, was finally disappearing from the seas. Obviously a new source of oil was needed. Then came the discovery—seemingly commonplace now—that actually formed the foundation of today's giant petroleum industry. It was simply that crude oil could be processed to provide an excellent fuel for lamps.

That was the curtain rising for the beginning of one of the greatest industrial dramas of this or any other time. It went on to the discovery of oil beneath the earth's surface, the recovery of the oil and the conversion of oil to highly useful products. Within less than a hundred years man's ingenuity and perseverance have made the discovery and recovery of petroleum a remarkably efficient operation and the industry's constant quest has converted the amazing liquid to more than 5,000 separate uses.

A geologist who has discovered an outcropping of bed-rock using a magnifying glass to look for prehistoric fossils. Note the geologist's hammer on the ground and other equipment carried





"The Petroleum Tree". The branches of this tree list some of the hundreds of oil products which play an important part in our everyday life.

Copyright Imperial Oil Limited

Birth of the Oil Age

Kerosene was the main product of the early refining process and the only one that was regarded as valuable; gasoline, a by-product, was thrown away. But in 1892 Charles E. Duryea stirred up real excitement among oil men everywhere with his invention of a motor car powered by gasoline. Automobiles made their debut in earnest not long afterward but it was not until 1910 that the demand for gasoline exceeded the demand for kerosene. Even after that kerosene was a very important petroleum product and it now seems that its importance will be assured since it is a basic part of the fuel required for the most widely used types of jet engines.

But those are only a few of the more familiar uses of petroleum, and new uses are being found all the time. Unless you were a busy commercial chemist you would never guess the number of other finished products made from petroleum or the number of industries for which it is a basic raw material. For example, if petroleum were suddenly banished the shelves of your drug store would be sadly depleted. There would be a shortage of laxatives, nasal sprays, germicides and ointments; lady shoppers would ask in vain for many perfumes, lotions and shampoos; antiseptics and disinfectants of many kinds would disappear entirely.

In the home petroleum's versatility is tested again. It may heat the house and insulate it as well. The paint and varnish may contain it. It may be part of laundry soaps, cleaning fluids and polishes. The coating of the wax paper that goes into the lunch box and the paraffin that seals the preserves both come from oil.

On the farm petroleum powers much of the machinery, helps ripen the fruit, kills bugs, keeps down weeds, disinfects livestock, fuels the incubator that hatches the chickens. The farm wife may cook with petroleum gas while the children do their homework by the light of a kerosene lamp. Petroleum takes the farmer's produce to market and takes the family to town on Saturday night and to church on Sunday.

Petroleum played a vital part in democracy's victory in World War II. It supplied



Before going out on a survey geologists carefully study aerial maps of promising areas.



Survey parties use many methods of transport in their search for oil. This party is travelling by pack train through the Alberta foothills of the Rocky Mountains.

high octane aviation fuel to the services. It went into incendiary and demolition bombs, flame throwers, shells and grenades. It furnished lubricants that were equally efficient on land or under water. It drove the mammoth tanks and the huge planes. It even dispelled the fog from landing fields.

Petroleum is also the base of the synthetic rubber industry. It is widely used in the manufacture of plastics that are replacing metal, wood and glass in the aeroplane, automobile and furniture industries. It goes into the making of textiles and household utensils. It is, in fact, difficult to think of anything that people do or use where petroleum does not play a part. Can anything else challenge petroleum's position as man's most versatile servant?

The Marvellous Mineral

What is petroleum? In its thousands of forms it appears to be all things to all men, but what is it basically? What is it made of—and how is it made?

It is impossible to give a short and simple answer that is at the same time complete but, in general, the facts are these. Petroleum is a hydrocarbon, a complex mixture of molecules composed of hydrogen and carbon atoms which combine in many ways to form almost numberless chemical compounds. Sometimes it is a liquid, sometimes a solid and sometimes a gas that is lighter than air.

Years of work and millions of dollars spent in research have taught scientists a great deal about the atoms of carbon and hydrogen even though they, like all other atoms, are too tiny to be seen. It is known, for example, that each carbon atom behaves as though it had four arms, each able to hold on to an atom of some other element or to another carbon atom. When a carbon atom holds on to four hydrogen atoms the five atoms together form a molecule of a gas called methane. *Methane is the simplest of all hydrocarbons and is the chief constituent of the natural gas that is burned in the gas ranges in many a kitchen.

One of the notable characteristics of the hydrocarbons is the ability of their atoms to combine in series, which makes possible the creation, either naturally or by chemical reaction, of a large number of different substances with definite family resemblances. The methane molecule is simple; other hydrocarbon molecules are highly complex.

Those hydrocarbons with few carbon atoms are gases; when five carbon atoms are present the hydrocarbon is a liquid with a low boiling point; six, seven and eight carbon atoms present liquids that boil at successively higher temperatures. These hydrocarbons are suitable for the manufacture of gasoline.

Hydrocarbons with ten or twelve carbon atoms are no longer suitable for gasoline but make good kerosene. Larger molecules are useful for making fuel oil and when the number of carbon atoms per molecule is twenty or more the hydrocarbon is a solid wax. The simpler hydrocarbon molecules are straight. Others are branched and still others are ring-shaped.

One of the most useful characteristics of the hydrocarbons is that they will burn. Hydrogen itself gives off more heat in combustion than any other substance but it is not a practical fuel. But when it is combined with carbon to make petroleum excellent fuels are created—about fifty per cent better, pound for pound, than the best coal, which contains very little hydrogen but a great deal of carbon.

Ever since the petroleum industry began to grow the challenge that has faced oil men has been to organize the atoms of petroleum into the combinations that would be the most useful for the many jobs that petroleum has to do. The whole process of refining has as its object the separation of groups of hydrocarbon molecules or the rearrangement of the carbon and hydrogen atoms in petroleum to provide the particular combination that will have the exact characteristics needed for a particular job. Some of the end products are gases, some are volatile liquids, some are slow-burning liquids and some are solids.

All of that is merely a part of the story of what petroleum is. The petroleum re-

*The chemical formula for methane is written $H-\overset{H}{\underset{H}{C}}-H$, a carbon atom holding four hydrogen atoms.



Setting off man-made earthquakes is one way of looking for oil. Dynamite is exploded in a hole drilled into the ground. Shock waves from the explosion are picked up by microphones (geophones) spread out at intervals along the ground and recorded on photographic paper in the sound truck shown at right. The photographic record gives an indication of the structure of underground rocks. Here the dynamite charge has just been set off in the search for oil in the Edmonton area.

searcher knows a great deal about his material and will undoubtedly know still more in time. Some day he may even know exactly how petroleum was originally formed. He does not know now, although he has a strong theory, well bolstered by scientifically gathered evidence.

Prologue to the Drama

Nature's manufacture of oil began some half billion years ago. During the long periods of Palaeozoic, Mesozoic and Cenozoic time, the seas teemed with animal life. The earth's crust was not continuously stable but from time to time was shifting. Great plains would subside and the ocean waters roll in and cover them. When uplift occurred in turn the seas would recede. During the times of submergence layer upon layer of mud, sand, and lime carrying plant and animal remains were deposited sometimes to a total thickness of several miles. Buried far underground the organic matter became subjected to tremendous pressure and heat and as a result—no one knows precisely how—it was changed into oil.

Scientists have taken shale and limestone containing fossilized plant and animal organisms and have made them yield oil. At the same time it remains one of nature's mysteries that you never find oil "ready made" in underground masses of these same rocks. Apparently all of the earth's oil has been

squeezed out of the rocks in which it was born into more porous strata. Sometimes huge quantities of oil accumulated deep in the earth where formations were right for holding the billions upon billions of droplets that seeped through these natural but constricted underground pipelines. Always the tendency of the oil is to move upward toward the earth's surface. The movement finally stops only when the oil is caught and held by a dense rock formation through which it cannot seep. These upside-down-teacup structures are the lids that oil men must puncture if they are to find oil in its natural containers.

To discover this knowledge the oil industry has spent hundreds of millions of dollars in research and drilling work since men started to hunt for oil underground.

Oil and The New World

Oil was brought into commercial production for the first time in this continent's history less than a hundred years ago. Some authorities mark the beginning of North America's petroleum saga with the discovery of the Drake well near Titusville, Pennsylvania, in 1859, but it is worth noting that James M. Williams was producing and refining oil in Lambton County in Western Ontario two years earlier than that. Alexander Murray, then assistant provincial geologist, reported that test wells had been drilled as early as 1851. The Globe newspaper in 1851 reported that Williams had drilled two wells, 100 and 150 feet deep respectively.

The oil-bearing area in Western Ontario is of more than historical interest not only because half-century-old wells are still producing but also because new wells nearby, brought in within the last few months, offer by contrast a clear picture of the tremendous strides that have been made in the methods of discovering and recovering the precious liquid. Wells near Oil Springs, Canada's first oil field, still produce a trickle of crude. Nearby, in the Becher field, the oil seekers have begun to harvest "second crop" oil by the use of modern and efficient techniques.

Even so, finding the secret hiding places of the underground oil pools is still a gamble. Today science and invention, with nearly a century of experience to draw on, have done much to improve the oil seeker's chances of success. Today's seeker is highly trained for his job and he has a great deal more than psychic hunches and vague theories to help him in his search. First step in the search is for a field geologist—whose workday travels may be by canoe, packtrain, automobile or aeroplane—to examine the surface structure of the earth. He looks for his clues in rocks laid bare by rivers and streams or in the ragged outcroppings thrust up by some long past compound fracture of the earth's crust. To his trained eye the rock layers are the pages of history. By studying fossils imbedded in the rock he can tell the age of the rock. By studying the slopes of the rock formations he can find the types of rock structures which may trap oil.

But in some sections of the world, such as Canada's western plains, there are few outcroppings for ready study. Here the oil seekers sink hollow drill bits deep into the earth. Geologists who are specialists in subsurface work study the samples of rock taken by the drillers and look for the same clues that the field geologist would hope to find at the surface. It is up to the geologists to picture how the rocks are behaving a mile



This oil well has just been completed and the petroleum engineer is seen regulating the flow of natural gas which has been separated from the oil. The meter attached to the pipe records the amount of gas flowing. The drilling derrick will be dismantled and re-erected at another site to drill a new well.



Drilling scene at an Alberta well. As the drill bit cuts its way into the rock the drillers add lengths of drill pipe at the top. Here one man holds the pipe in giant tongs while the other "spins in" a new length with a power driven rope. The final tightening will be made with the tongs. The men are standing on the "rotary table" which transmits power from the engines to turn the drill pipe



This driller carries a rotary drilling bit on his shoulder.

or two beneath their feet and to calculate the chance of finding oil.

Geophysics, the application of physics to the science of geology, is a new and useful aid for the oil seeker. Using delicate devices in the same way that radar is used to locate ships and aircraft, he can produce a graphic picture of the types and depths of the various strata buried far below the earth's surface. Most useful tool of all to Canadians in their perpetual oil hunt has been the seismograph, the same instrument that has long been famous as a recorder of earthquakes. In fact the oil seeker uses the instrument in the same way as the scientist who is interested in earthquakes; the main difference is that the oil man does not wait for a natural earthquake to study—he makes his own. The seismograph crew drills a hole, places dynamite inside and sets off an explosion. Shock waves travel from that source in all directions. Some of them hit layers of rock deep in the earth and bounce back to the surface where they are detected by the microphone of the seismograph, a mechanism so finely adjusted that it can measure the force of the footsteps of an ant. The time it took the waves to travel down and back is measured in thousandths of a second and recorded on a chart. Knowing the rate of speed of the waves through solid matter, the searchers can calculate the depth of the rock layers that bounced the waves back. With luck they can learn much more. They may get a remarkably accurate picture of the shape and extent of the rock structures below and they may get assurance that the rock cap they are looking for is actually present.

When all the evidence is collected a decision is made. There are clues from the field geologists' studies, from the sample core drilling, from chemical analysis of the soil, from aeroplane reconnaissance of the area and from the geophysicists. If the clues add up to a promise of success an oil well is drilled.

The Only Test

The search may have been thorough, the evidence may be complete but only the drilling will prove that there is oil below. Most modern drilling rigs are of the rotary type. A bit in the end of a length of drill pipe, rotated at great speed, gnaws its way into the earth. As depth increases more sections of drill pipe are added. Some of the bits, for example the "fish-tail", are simple affairs. Others are complex arrangements of toothed rollers, specially made of hardened steel and set up for dealing with the hardest rock. All the time drilling goes on fluid mud is circulated down through the drill pipe and back to the surface outside the pipe. The mud carries the rock cuttings to the surface, lines the walls of the hole to prevent cave-ins and at the same time prevents oil or gas in the well from breaking through prematurely.

When the hole reaches the depth where oil is expected special "core barrels" are used to pick up samples to be tested for porosity and the presence of oil. Several rotary-drilled holes in the United States have reached a depth of over three miles. The deepest to date in Canada went to 14,686 feet.

Usually it is not a great problem to bring oil to the surface once it has been found. If there is not enough gas pressure to force the oil to flow, then it can be pumped. But getting the oil from the well to the refinery is a different matter. Naturally it is better to have a refinery near a consuming market



A well blowing into production. When an oil well first "blows in" the oil and natural gas coming up from the producing formation below are mixed with mud, water and chemicals used in drilling the hole. Since these would contaminate the storage tanks the flow is turned into a flare and burnt for a few minutes until the well cleans itself out.

than to have it near an oil field. Then you have only one material to transport a considerable distance, not several—or several score. Even transporting the one material—the crude oil—is a big job. To do it the oil industry has necessarily gone into the transportation business in a large way. Specially built tank ships, some of them capable of carrying 228,000 barrels, ply the seas carrying crude from oil well to oil refinery. Over land the favourite method of carrying oil is by pipeline. Usually these lines are laid underground but in some countries they may be seen sprawling across the surface like some huge, endless snake. They may be more than two feet in diameter and often have to span gullies or slip down, across, and up a deep, wide river bed. Giant pumps force the oil through the pipeline. If the land is flat not many pumps are required; if it is hilly the pumping stations must be much closer together.

Where there are no pipelines railway tank cars are used. Long trains of such cars, each carrying as much as 10,000 gallons, have been a common sight on Canada's prairies. In a new field, or where an isolated well is involved, crude oil is sometimes carried by tank trucks on road and highway.

The Manufacturing Process

However it reaches the refinery the crude oil is stored there in huge tanks until it is drawn off to be processed. The basic operation in oil refining is distillation. Over the years as more and more has been learned about petroleum and as more and more pro-

ducts have been created, distillation has become a complex business and one that demands a tremendous investment in physical plant. The pipes and pumps and towers of even the smallest refinery form a pattern that is completely meaningless to the man not educated to their function, yet the whole process of distillation may still be described simply as the process of applying heat to liquid to cause evaporation and then condensing the resulting vapours by cooling. This first move is accomplished by heating the crude to a temperature of about 750 degrees Fahrenheit and passing it into a tall, steel cylinder known as a bubble tower. The heated oil turns to vapour which rises toward the top through a series of perforated trays on which the vapours condense. The lighter parts of the crude—those with the lowest boiling points—rise high in the tower, some of them passing out still in vapour form. The heavier parts condense on the lower trays.

These raw "fractions" of petroleum, ranging from the lightest gasoline vapours through kerosenes, diesel and heating oils, lubricants, heavy fuel oils down to asphalt, are the primary products of the refinery. Finished goods are manufactured from these near-basic materials by further processing. This may involve redistillation, chemical treatment, filtering through clay or Fullers earth. Or it may consist of solvent extraction, solvent dewaxing and other processes. Always the steps are leading toward some finished product that is useful in this modern petroleum age.

One of the newer and more remarkable phases of petroleum refining is the "catalytic cracking" process. This is a means of recovering greater quantities of the lighter fractions from oil, a situation made necessary by the tremendously increased demand for higher quality automobile and aeroplane fuels in the past few years. The cracking process uses not only heat but also the help



A construction foreman checks a huge valve on the eight-mile pipeline from the Leduc field to the railhead at Nisku, where crude oil is stored to be transported by tank cars to western refineries.



Tankers travel the oceans and the Great Lakes carrying crude oil and refined products for Canada. This tanker, the largest ever built in Canada, holds nearly two million gallons and operates on the Great Lakes.

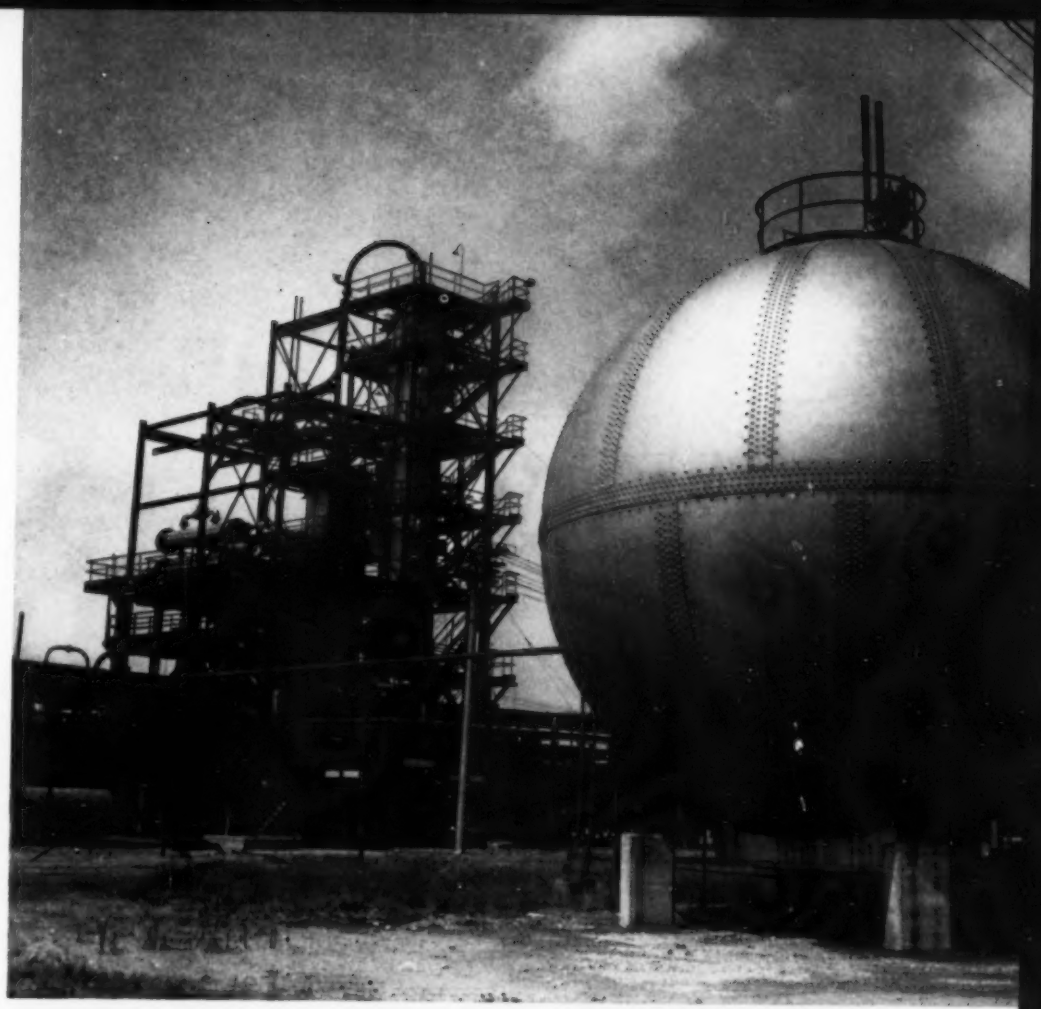


A portion of a refinery showing railway tank cars, loading racks, refining units and storage tanks.

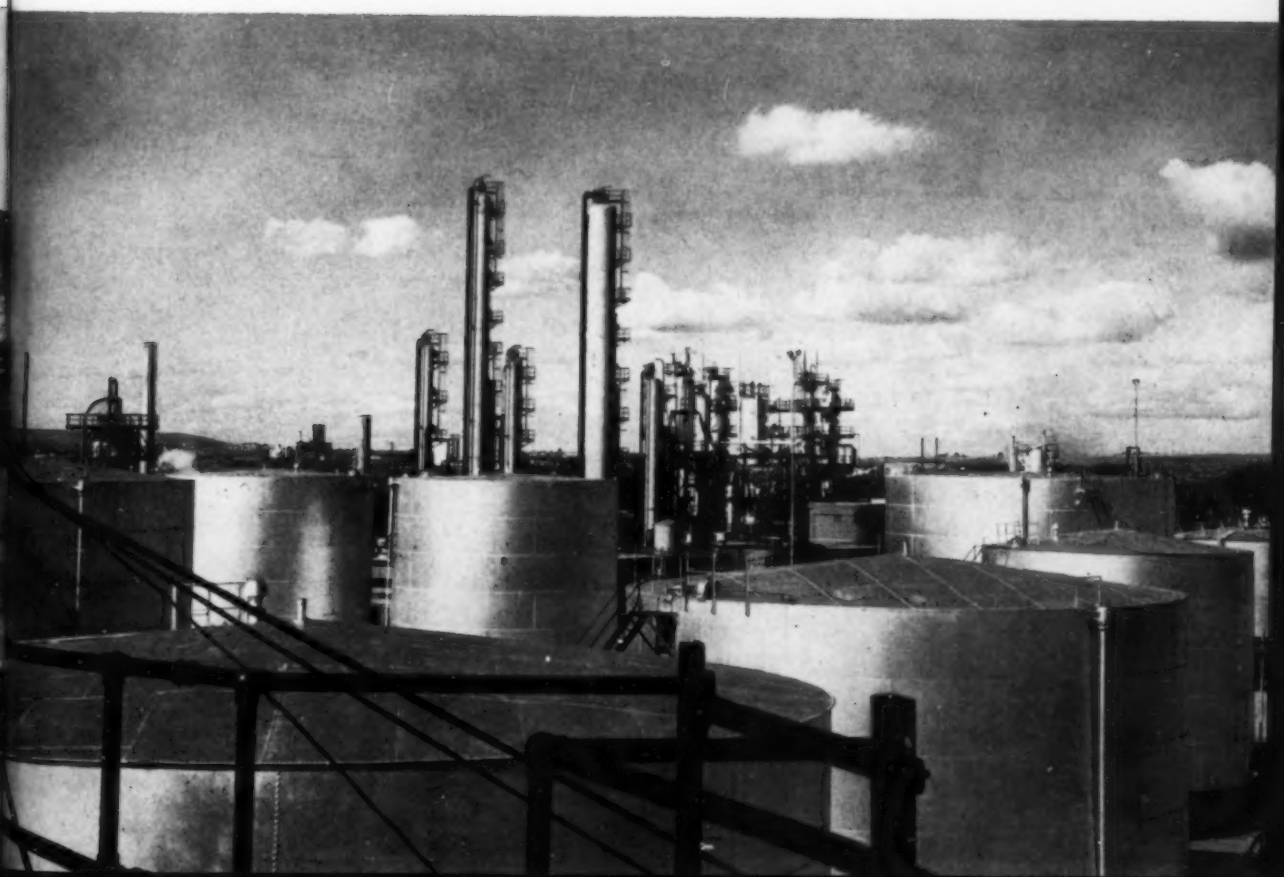
travel th
d the Grea
rying crud
efined pro
Canada
ker, the
er built i
olds near
ion gallons
tes on the
es.

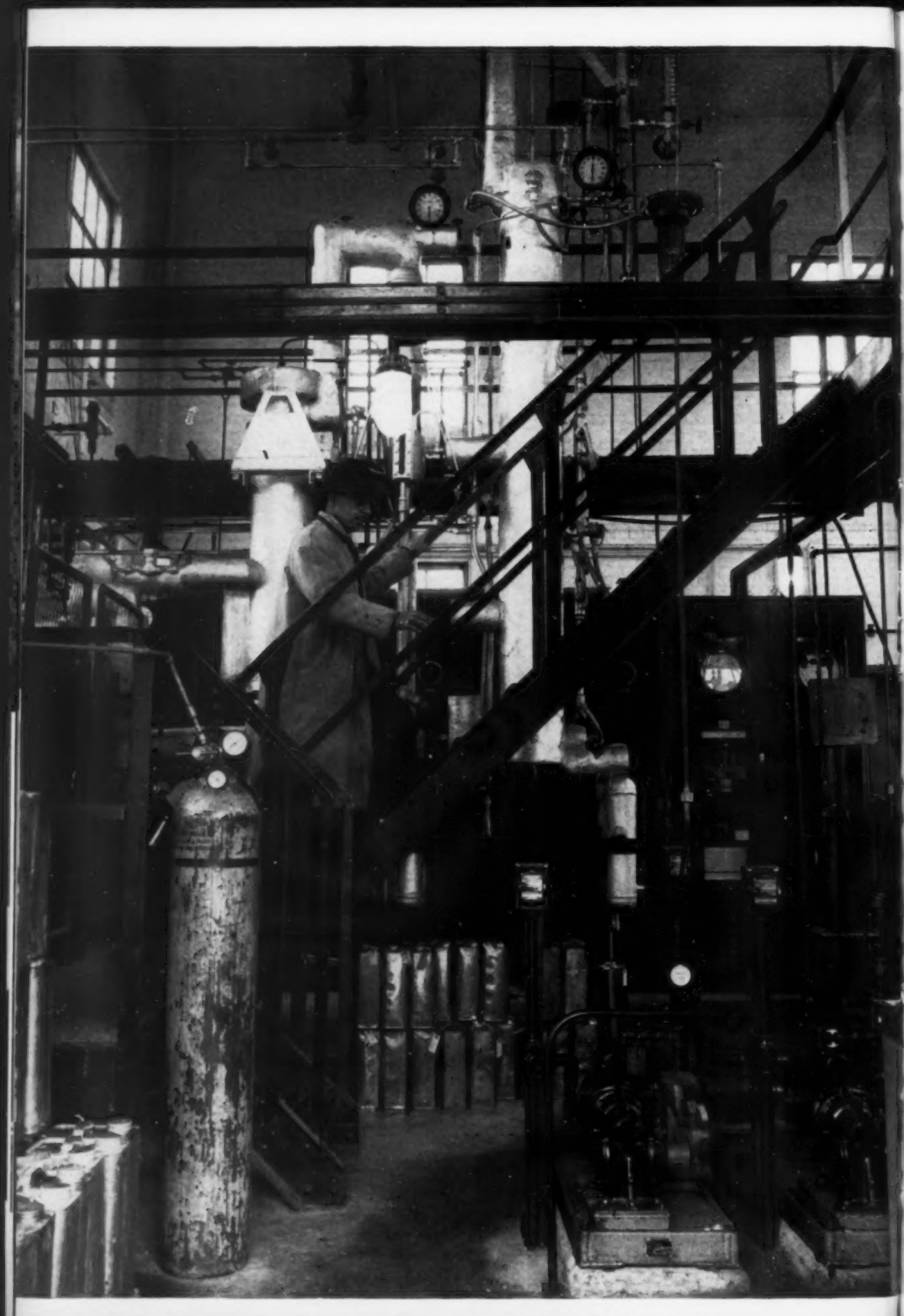
of a refin
g railway
loading
ning units
ge tanks.

Light ends unit and storage sphere at the Sarnia refinery of Imperial Oil. The sphere is designed to store petroleum gas under high pressure.



Storage tanks and refining units of the Imperial Oil Limited on the outskirts of Calgary, Alberta. This refinery can process 10,000 barrels of crude oil daily. The tall slender fractionation towers are part of a unit which makes "alkylate", a very high octane fuel used in aviation gasoline.





Lef
The
ref
Thi
mir
car
oct

of a chemical agent called a catalyst. Mixed with oil the catalyst guides the cracking reaction to produce more of the desirable high octane gasoline without being changed itself in the reaction.

Within the past year two fluid catalytic cracking units have been put into operation by Canadian petroleum companies and a third is nearing completion. The "cat" cracker is the most modern and efficient of all the crackers. The catalyst it uses, a fine clay-like powder, is fluffed up by a stream of air or gas so that it will flow like a liquid. Mixing with the preheated gas oil that is the "cat" cracker's raw material, it moves through the cracker's maze of pipes and vessels until its work is done. By this time the catalyst particles have become coated with carbon resulting from the cracking reaction and the catalyst can no longer do its job. It is separated from the oil vapours and carried to a regenerator by a stream of air. The same air that moves the catalyst burns off the carbon and the catalyst is again ready to mix more gas oil flowing into the unit.

With their high capacity and continuous flow the three new Canadian "cat" crackers, first of which went to work in September of 1948, will do much to carry the load imposed by Canada's increasing demand for superior gasoline.

Supply and Demand

The current demand is by no means limited to gasoline nor is it localized in Canada; the whole world wants more and more of all petroleum products. Some idea of the vast amount that must be made available to satisfy the world-wide need may be gained from the fact that Canada, with her comparatively small population of about thirteen million people, uses about two million barrels of petroleum every week. Canada is second in per capita consumption to the United States.

Between 1859, when commercial production began, and January 1, 1949, the world's production of petroleum totalled 58,300,000,000 barrels. During 1948 alone world production was 3,404,574,000 barrels and proved reserves—oil that has been located in established fields and is ready for the taking as the need arises—stood at 78,322,000,000 barrels.

Largest oil producer among the nations is the United States whose two billion barrels a year amounts to about 60 per cent of the world's total. Venezuela is second with just under half a billion barrels a year and Russia third with about two hundred million barrels.

The North American continent in 1948 produced 2,087,412,000 barrels of oil; South

Fractionation tower at Sarnia. Crude oil, heated to about 750°F. is pumped into this tower and the raw primary products are drawn off through the piping. Gasoline, kerosene, diesel and furnace fuels, gas oil and "reduced" crude flow from this tower.



Left:—
The oil industry continually seeks better ways of refining oil to produce more and better products. This is an experimental pilot plant—a complete miniature refining unit—where studies are being carried out on the use of catalysts to produce high octane gasoline.

America 575,679,000 barrels; Europe 260,095,000 barrels; Africa 11,484,000 barrels; the Middle East 411,596,000 barrels; and the Far East 58,306,000 barrels. While in Canada the exploration work, discovery of oil fields and construction of refinery facilities are under rapid development, our last year's production of 12,543,000 barrels of crude had to be augmented by the importation of an additional 77,336,139 barrels of crude and more than 18,000,000 barrels of petroleum products.

To the layman it might seem that these astronomical figures of oil production and proved reserves would mean that almost all the world's supply of oil had been discovered and that we might be approaching a day of irremediable petroleum famine. The fact is that man's search for oil has not yet covered half the area in which oil may be found. Even in the United States only a third of the possible oil-producing areas have been explored; one and a half million square miles of sedimentary rock remains untouched. Canada has an area of 560,000 square miles of sedimentary rock, much of which is potentially oil bearing. Canada's existing oil fields total about 100 square miles. Even so, Canada has produced 143,000,000 barrels of oil and has a known reserve of about 1,000,000,000 barrels.

Potentialities of other parts of the world are even better and even if this huge stockpile should be used up some day the oil industry would be prepared to maintain its production since scientists have already discovered how to recover petroleum from oil shale, and to synthesize it from coal and from natural gas. A plant is being built in the southern United States to process natural gas into gasoline and chemicals. The world resources of gas, coal and oil shale must be computed in fantastic figures; in coal alone the United States has the equivalent of a thousand years' supply of liquid fuel.

Canada's Oil Wealth

What is Canada's place in the petroleum world and what will be her probable place in the future?

Except in the very earliest days of the oil industry, when development in Western Ontario kept pace with that in Pennsylvania, Canada has been an oil importing country. In 1894 Ontario fields produced nearly a million barrels but, unfortunately, as demand went up production declined. Now those pioneer pools along with the recent discoveries are good for only some 176,000 barrels a year.

Canada's prewar import of oil, an average of 35,000,000 barrels a year, has now been more than doubled. Over fifty per cent of the crude oil and refined products comes from the United States, most of the remainder from Colombia, Venezuela and Trinidad. During 1948 over four million barrels came from the Middle East.

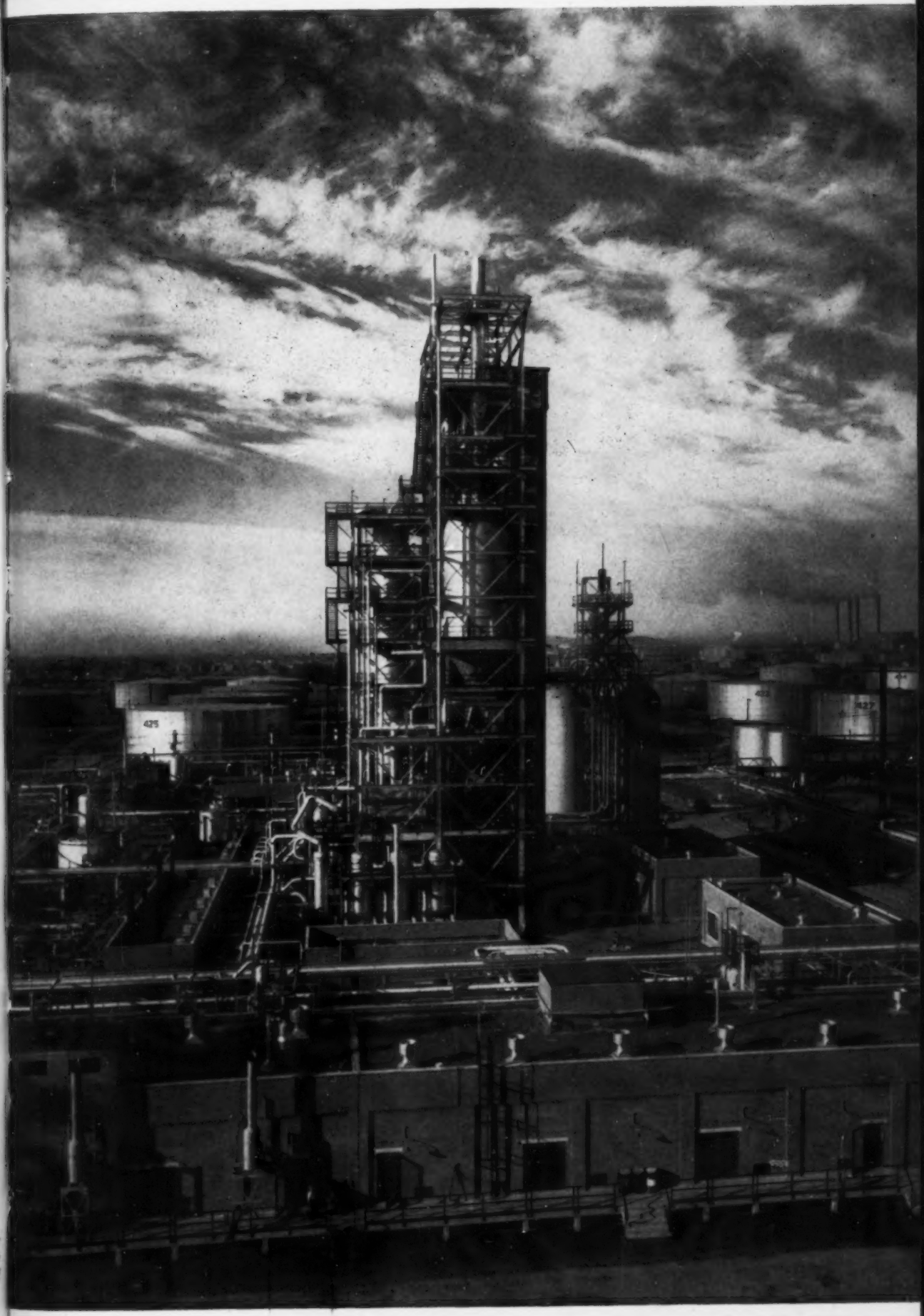
British Columbia draws its supplies from California and South America by sea. The prairie provinces receive most of their crude oil from Alberta while the remainder comes from the United States. Ontario depends mainly on the United States. South American, Gulf Coast and Middle East crudes supply Quebec, mainly by tanker to Portland, Maine, and then through a 230-mile pipeline that overcomes the handicap of the frozen St. Lawrence during the winter months. The Maritimes get South American and Middle East crudes delivered by tanker to Halifax.

It is obvious that the cost of carrying crude oil from these distant fields has no little effect on the price of petroleum products marketed in Canada. It is equally true that the many millions of dollars sent out of the country to pay for the crude oil is a serious drain on Canada's reserves of United States funds.

For these reasons every additional barrel of crude oil that can be brought out of a Canadian well and taken to market represents a cash saving to petroleum users and every new field brought into production is good for Canada's over-all economy.

From the very beginning the Canadian oil industry has recognized the advantages of an adequate domestic supply and has spent millions of dollars in its search for

Fluid catalytic cracking at Imperial Oil's Montreal East refinery which has a capacity of 11,000 barrels daily. Fluid catalytic cracking unit is one of the latest developments in refining and produces high octane gasoline.





Aerial view of the oil refining facilities at Montreal East, Quebec. Visible in the picture are the refineries of Imperial Oil Ltd., McColl-Frontenac Oil Co. Ltd., Shell Oil Co. of Canada Ltd., and a portion of the British American Oil Co. Ltd. These four refineries can process over 100,000 barrels of crude oil daily.

new fields. The search has centred mainly in Western Canada and at the present moment Alberta, in particular, is the scene of a tremendous exploratory effort.

Several important discoveries have been made in Canada, most of them in the past few years. Turner Valley, forty miles south of Calgary, was pioneered in 1914 and came into the limelight in 1924 with large production of natural gas saturated with naphtha. In 1936 crude oil was discovered on the west side of the field and production went up to a peak of 10,000,000 barrels in 1942. To date the field has contributed nearly 100,000,000 barrels and, although production is now declining, it is still good for many years of usefulness.

The second important find was on the bank of the Mackenzie River in the Northwest Territories. The Discovery well was drilled at Norman Wells in 1920 but only came to prominence during the war when it was the centre of the Canol Project, designed by the United States and Canadian governments as a safeguard against Japanese attack.

Intensive drilling made it possible to send well over a million barrels of oil through the 600-mile Canol pipeline to the refinery at Whitehorse in 1944. It was converted

Articles dealing with oil which have previously appeared in the *Journal* include the following: Bituminous Sands of Alberta by S. C. Ells, April 1933; Oil from the Sea by Neal M. Carter, December 1937; The Petroleum Industry of Canada by Walter Francis, February 1938; Research Touches the North by S. C. Ells, June 1942; The "Canol" Project by Oliver B. Hopkins, November 1943; Canadian Petroleum Goes "G.S." by John Ness, July 1945; The Epic of Canol by Richard Finnie, March 1947; Alberta—Nature's Treasure House by A. J. Hooke, October 1947.

mainly to aviation fuel. Now the field is largely shut in, confining its activities to producing crude oil for the small refinery at Norman Wells which supplies the mining industry at Yellowknife and Eldorado and other consumers in the far reaches of the north.

Really big news broke in the oil world on February 13, 1947, when Imperial-Leduc No. 1 was brought in sixteen miles south of Edmonton. During the following months the Leduc field expanded rapidly. It is now estimated to have a reserve of 200,000,000 barrels. A pipeline has been laid from the field to a new refinery in Edmonton.

Success at Leduc has stimulated more intensive activity in other western centres where geologists feel that a search may be worth while. Early in 1948 the Woodbend field was discovered some three miles north of Leduc. In September a well near Redwater revealed another field which has been called the greatest discovery in North America in 1948. Then, early in 1949, Imperial-Schoepp No. 1 discovered the Golden Spike field about twenty-two miles southwest of Edmonton. This well encountered 545 feet of oil-bearing rock, the thickest ever found in Canada.

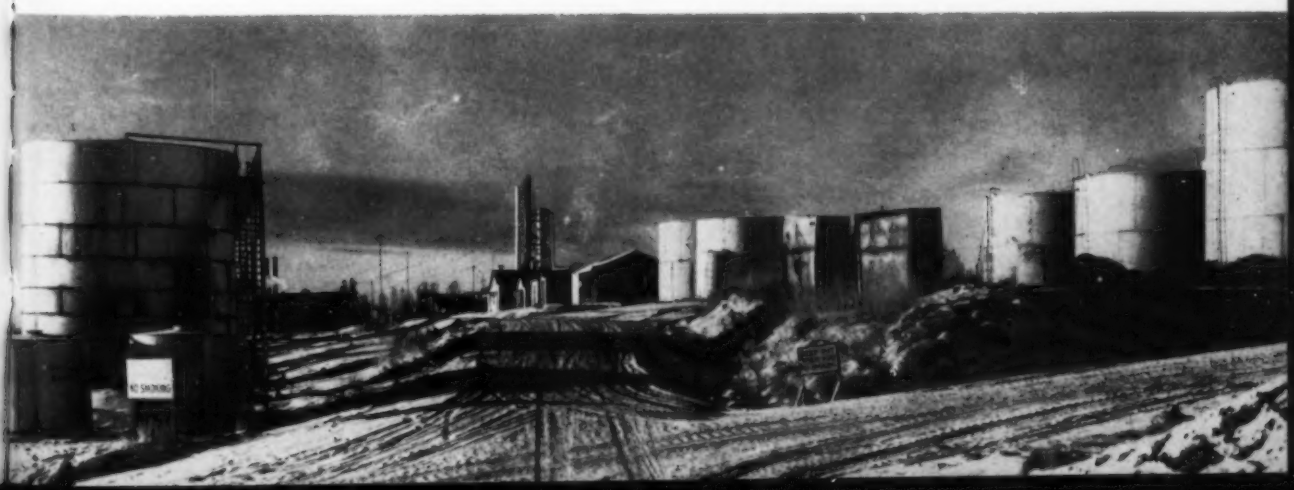
New discoveries have been made at Barrhead, White Mud, Joseph Lake, Bon Accord, Stettler and Pincher Creek. The importance of these finds will not be known until further drilling has been carried out.

Potential oil production from the new fields already exceed both refinery capacity and demand in the prairies. To be of maximum benefit to the country, the oil must be transported to large new markets at low cost and to this end a 150,000 mile pipeline is being constructed from Edmonton to the Great Lakes. It will supply the prairie refineries along the route and tankers will carry Alberta crude oil to refineries on the Great Lakes. The pipeline will cost about $90,000,000 to construct and it is expected to be in full operation by the spring of 1951.

Besides the known oil fields Canada has a huge reserve in the Athabaska tar sands. This area consists of some 10,000 square miles of oil-bearing sand as much as 200 feet deep. So far no economical method of recovering the oil has been discovered but oil men unanimously believe that the problem will some day be solved. When that day arrives Canada will have a tremendously rich resource, perhaps a hundred billion barrels of oil—enough to supply the whole world for upwards of thirty years. The tar sands alone seem to be an answer to the fear that the world is running short of oil.

In its comparatively short lifetime the petroleum industry has played out the opening scenes of one of the richest dramas the world has ever seen. It is a story of fast and vigorous action, ingenious experiment and daring enterprise. How it will develop no one can say; the remaining acts have not yet been written. But some things are clear: the world's oil supply is not in danger of running out in any forseeable period; Canada is taking a larger part in the drama and may be, for many, many years, very close to the centre of the stage.

Imperial Oil's refinery at Norman Wells, N.W.T., about 90 miles south of the Arctic circle, which has a capacity of 1,100 barrels daily.





U. K. Information Office

The Bridge of the Giants

by HARRIET GEITHMANN

THE LEGENDARY QUARREL of a pair of Irish-Scottish giants is responsible for the name and much of the glamour that clings to the Giant's Causeway on the northeastern coast of the Emerald Isle. That one of the world's geological wonders waits there behind a picket fence through which one enters by way of a turnstile after depositing sixpence detracts not one whit from its geological and legendary glory.

In County Antrim, long before the memory of man, lived an Irish giant who enjoyed a feud with his neighbour, a Scottish giant who dwelt at Fingals Cave on the shores of Staffa Island across the choppy waves of St. Patrick's Channel. After much bickering he challenged his Scottish neighbour to visit Ireland and fight it out. The valiant Scot said he would be glad to accommodate his Irish opponent if he would build a bridge. This was done without delay. With the completion of the causeway, which Webster defines as "a raised way across wet ground", the Scottish giant strode over one day and they settled all their differences by force of arms. Though there are no records available as to who won the famous bout almost any one living along the romantic coast of County Antrim is satisfied that the Irish giant was victorious. And there is the causeway to prove the story. At Fingals Cave on the Scottish side of the channel there is evidence of the same interesting formation.

In visiting the Giant's Causeway in the twentieth century, one is reminded at every turn in the stony trail of the giants and their romantic day. For instance there are the various formations known as the Giant's Horseshoe, the Giant's Honeycomb, the Giant's Cannon, the Giant's Loom which towers thirty feet high, the Giant's Gateway, the Giant's Organ Pipes and the Giant's Wishing Chair, a regular Morris chair of stone which stands on a raised platform with its back to the sea. Here the visitor pauses in his geological survey while he sits in this famous chair and meekly and hopefully follows the aged guide's command: "Make three wishes and they will all come true if you don't tell anybody." And then there is the Giant's Wishing Well on the brink of which sits the guide's white-haired buxom spouse with pitchers of sparkling spring water and cups for thirsty mortals.

To the left of the Causeway is the stony figure of the Giant's hoary grandmother who is forever and ever crawling up a steep grade with a sack of chicken feed on her venerable back. You may watch her as long as you please, you will never see her reach the summit of the little hill. Beyond the

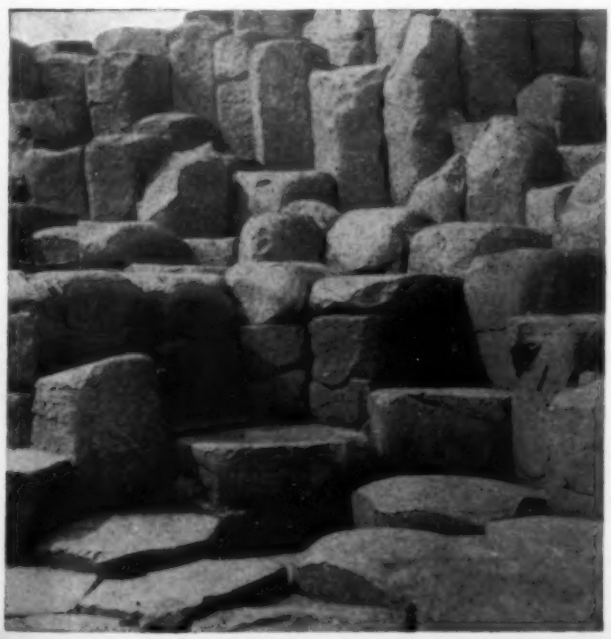
point is Spanish Bay, the very spot where the Spanish Armada was destroyed by the Irish giants because the soldiers had dared to fire their guns at the chalky cliffs along Antrim's shore, believing them to be fortresses.

While all who will may still believe in the work of the giants, geologists maintain that the Giant's Causeway, three spits or natural piers of columnar basalt slanting out into the sea, are of volcanic origin. There are in reality three causeways, tongues of basaltic rock called the Little Causeway, the Middle or Honeycomb Causeway and the Grand Causeway. Here are tens of thousands of polygonal pillars of stone varying in height from a few inches to as much as twenty feet. While the majority of these stones are perpendicular, there are a few horizontal ones. Many sided are they, triangular, pentagonal, hexagonal, heptagonal, octagonal and the largest pillar of all has nine sides. There are but two of these nine-sided columns in the Causeway and both of them have been richly embroidered by Mother Nature with tawny lichens. The majority of the pillars, however, are hexagonal. Almost invariably the wide sides face one another and the narrow sides do likewise. When struck by a geologist's hammer they are found to be more or less sonorous. The diameter of these pillars varies from fifteen to twenty inches, and the ends of the pillars are either convex or concave, fitting in to one another.

While a few black pillars indicate the high water mark, the majority are a silver grey tone adorned here and there in the crevices with tiny pink flowers and orange and lemon lichens. Among the most distinctive members of this great family of stones one finds the Chimney Pots, the Keystone of the Causeway, the most perfect octagonal column, and the Bishop's Mitre, a five-sided pillar even on all sides and considered the most perfect one in the entire Causeway. The moss-grown Lady's Fan is a combination of five perfect pentagons and a heptagon.

On climbing up from the Causeway, the Irish end of the bridge of the giants, one lifts one's eyes to hills of purple heather and fields of gray-green oats starred with scarlet poppies. Along the limestone cliffs gleaming in the sunlight to the right, one sees the Giant's noble profile with his daring goatee, freckled nose sniffing the salty tang of the sea and his lofty forehead of white limestone beneath a cap of green moss with a button on top. All of which is a reminder that one is breathing an atmosphere of giants and will breathe it as long as one lingers on the romantic coast of Ulster.

The Giant's Wishing Chair, a raised platform of basalt.



The Lady's Wishing Arch of gleaming white limestone.







Eskimos of the Eastern Arctic. The men (above) are on Southampton Island. The family (left) at Chesterfield Inlet are wearing their modern clothes for Sunday.

Top right:—An R.C.A.F. Canso aircraft on the beach at Cambridge Bay, Victoria Island.



Recent Developments in the Canadian North*

by H. L. KEENLEYSIDE

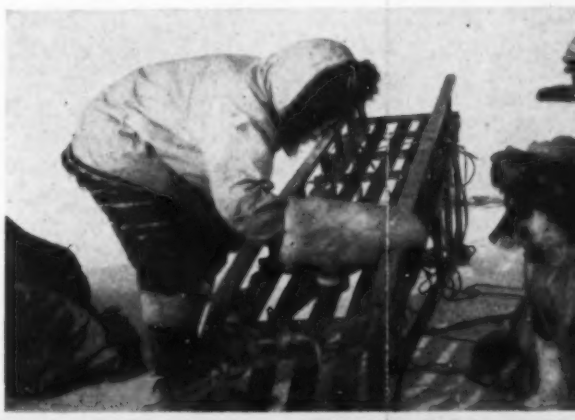
FOR MANY YEARS modern interest in polar areas was largely concentrated on the frozen regions of the Southern Hemisphere. The international race for the South Pole, first reached by Amundsen, the dramatic exploits and death of Sir Robert Scott and the quiet heroes who accompanied him, the development of commercial whaling in Antarctic seas, the establishment of Little America and the introduction of aircraft to the polar continent by Admiral Byrd, all attracted attention to the bottom of the world.

But there has been a sudden switch of interest. Today relatively little is heard of the Antarctic while never, even in the early days of the search for a northwest passage to the riches of the Indies, has there been so great a concentration on the problems of the north polar regions.

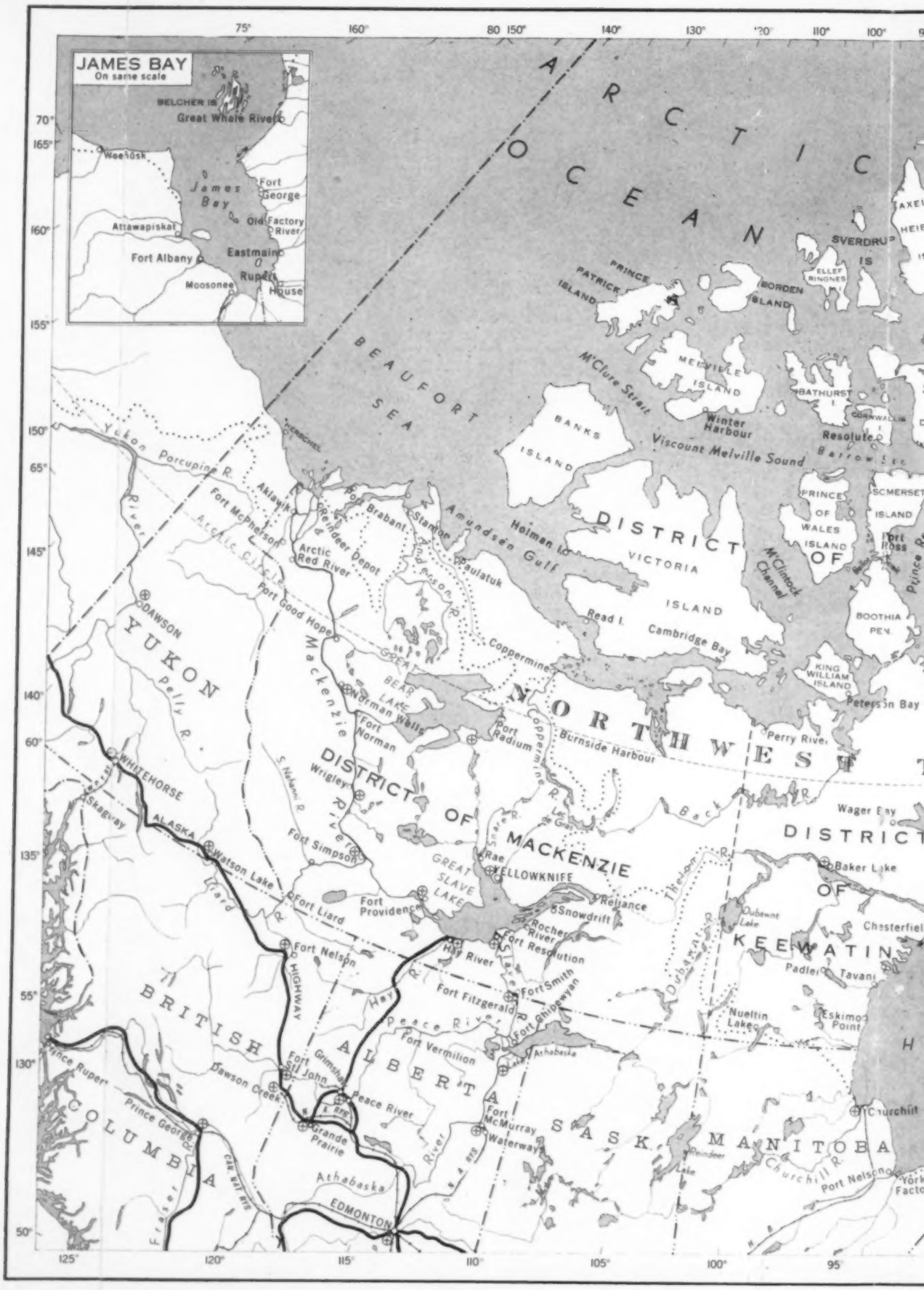
It is not difficult to identify the reasons for this change. Canadians and other northern people are being forced by the bitter facts of international life to free their minds from the shackles imposed by the flat distortions of the Mercator map, and to realize that the political, economic and military powers of the modern world are grouped about the Arctic Sea. Included among them are those two great national concentrations of strength and concept, the United States of America and the Union of Socialist Soviet Republics.

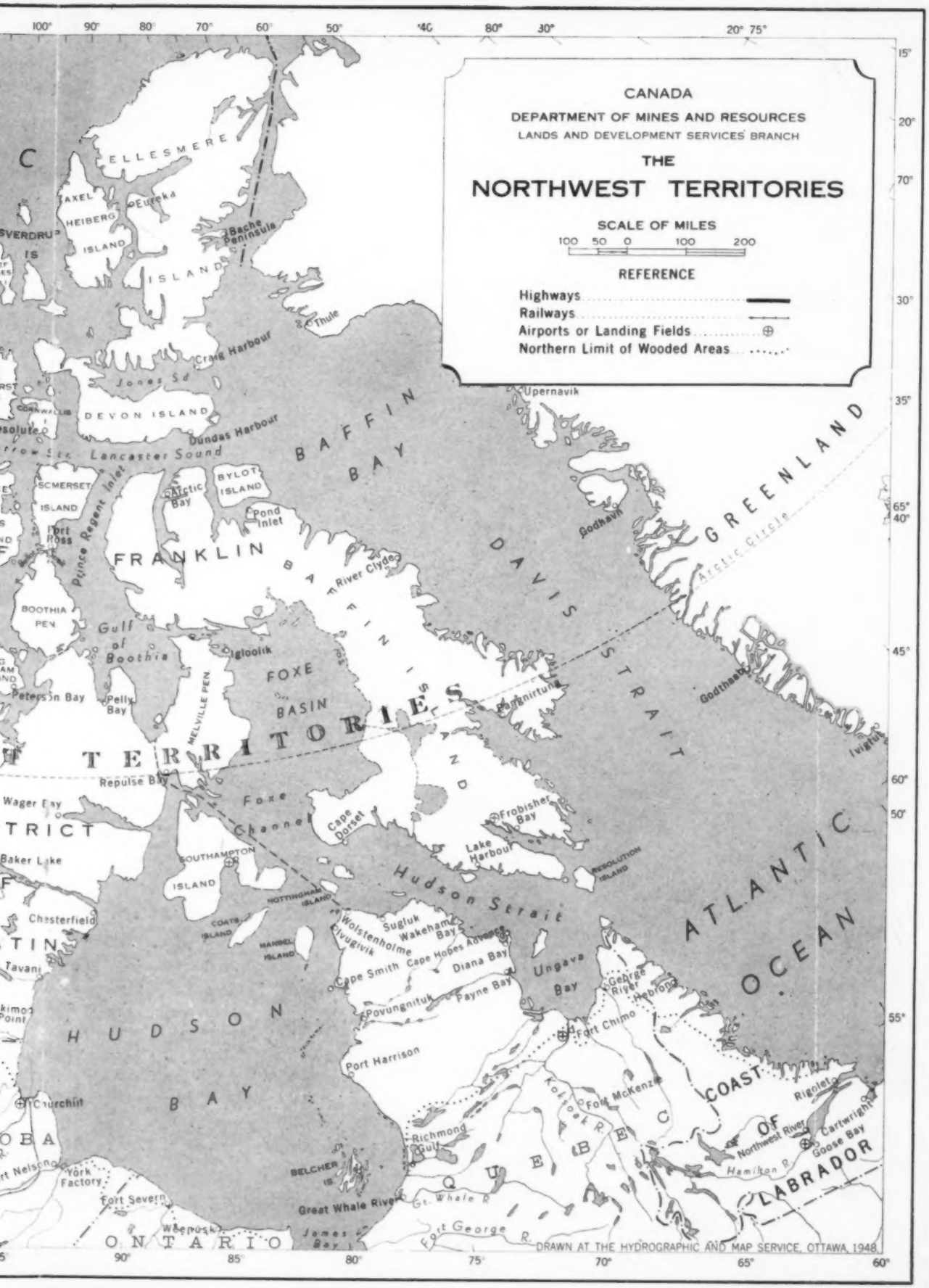
Despite the bitter lessons of two world wars some nations are again denying the

*This article is based on the Alumni Lecture delivered at McMaster University, 14th May, 1949.



Sled runners are given a coating of ice for easy travel over the snow.


JAMES BAY
On same scale
BELCHER IS
Great Whale River
Woetosk
James Bay
Fort George
Attawapiskat
Old Factory River
Fort Albany
Eastmain
Rupert House
Moosonee
ARCTIC OCEAN
BEAUFORT SEA
PRINCE PATRICK ISLAND
BORDEN ISLAND
SVERDRUP IS
ELLEF RINGNES
MELVILLE ISLAND
M'Clure Strait
BATHURST I
CORNWALLIS
Winter Harbour
Resolute
Viscount Melville Sound
BANKS ISLAND
PRINCE OF WALES ISLAND
SOMERSET ISLAND
Prince Regent Inlet
Fort Ross
Amundsen Gulf
Holman Is
VICTORIA ISLAND
Cambridge Bay
Read I
McClintock Channel
BOOTHIA PEN
KING WILLIAM ISLAND
Peterson Bay
Perry River
Burnside Harbour
Coppermine
Paulatuk
Stanton
Fort Brabant
Herschel
Yukon
Porcupine R.
Akiawik
Fort McPherson
Arctic Red River
Reindeer Depot
Arctic Circle
Fort Good Hope
Mackenzie River
DAWSON
YUKON
Pelly R.
WHITEHORSE
Skagway
ALASKA
Watson Lake
Liard R.
Fort Liard
Fort Nelson
HIGHWAY
BRITISH COLUMBIA
Prince Rupert
Prince George
Dawson Creek
Fraser R.
Canadian Nat'l Rys
Grande Prairie
Peace River
Fort Vermilion
Fort St John
Grimshaw
ALBERTA
Athabaska
EDMONTON
Fort McMurray
Waterways
Athabasca River
Canadian Nat'l Rys
Great Bear Lake
Norman Wells
Fort Norman
Fort Radium
Wrigley
S. Nahanni R.
Fort Simpson
Fort Providence
Great Slave Lake
YELLOWKNIFE
Rae
Reliance
Snowdrift
Rocher River
Fort Resolution
Hay River
Fort Smith
Fort Fitzgerald
Fort Chipewyan
Slave R.
Peace River
NORTHWEST TERRITORIES
DISTRICT OF MACKENZIE
Wager Bay
DISTRICT OF KEEWATIN
Baker Lake
Back R.
Dubawnt Lake
Chesterfield
Padlei
Tavani
Nueltin Lake
Eskimo Point
Churchill
SASKATCHEWAN
MANITOBA
Churchill R.
Port Nelson
Reindeer Lake
Lake Athabaska
Thelon R.
Dubawnt R.
75°
160°
80
150°
140°
130°
120°
110°
100°
70°
165°
160°
155°
150°
65°
145°
140°
60°
135°
55°
130°
50°
125°
120°
115°
110°
105°
100°
95°


CANADA
DEPARTMENT OF MINES AND RESOURCES
LANDS AND DEVELOPMENT SERVICES BRANCH
THE
NORTHWEST TERRITORIES
SCALE OF MILES
100 50 0 100 200
REFERENCE
Highways
Railways
Airports or Landing Fields
Northern Limit of Wooded Areas
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
Eureka
Bache Peninsula
Thule
Craig Harbour
Jones Sd
DEVON ISLAND
Dundas Harbour
Lancaster Sound
CORNWALLIS ISLAND
SCMERSET ISLAND
Arctic Bay
BYLOT ISLAND
Pond Inlet
Prince Regent Inlet
Fort Ross
FRANKLIN
BAFFIN BAY
DAVIS STRAIT
GREENLAND
Upernavik
Godhavn
Arctic Circle
River Clyde
BOOTHIA PEN
Gulf of Boothia
Igloolik
FOXE BASIN
MELVILLE PEN
Peterson Bay
Pelly Bay
Repulse Bay
Wager Bay
Foxe Channel
Cape Dorset
Frobisher Bay
Lake Harbour
Godthaab
Ivigtut
Baker Lake
SOUTHAMPTON ISLAND
NOTTINGHAM ISLAND
COATS ISLAND
MANSEL ISLAND
RESOLUTION ISLAND
Hudson Strait
ATLANTIC OCEAN
Chesterfield
Wolstenholme
Sugluk
Wakeham Bay
Cape Hopes Advance
Cape Smith
Diana Bay
Ungava Bay
George River
Hebron
Povungnituk
Payne Bay
Fort Chimo
Port Harrison
HUDSON BAY
Churchill
Kolosoak R.
Fort McKenzie
COAST OF LABRADOR
Rigolet
Richmond Gulf
Northwest River
Cartwright
Goose Bay
Hamilton R.
QUEBEC
York Factory
Fort Nelson
Fort Severn
BELCHER IS.
Great Whale River
St. Whale R.
Fort George R.
ONTARIO
DRAWN AT THE HYDROGRAPHIC AND MAP SERVICE, OTTAWA, 1948.



ARCTIC BAY,
NORTHERN BAFFIN ISLAND

The panorama of the settlement (above) shows the buildings of the Department of Transport radio station, Hudson's Bay Company trading post, and Roman Catholic Mission. In the background is King George V Mountain.

Right:—An Eskimo family at the settlement.

truth—though without altering the fact—that humanity is inextricably united in One World. This heresy has been revived at the very time that science has placed in our hands an unexampled power of destruction. But whether the nations choose peace or war, whether we exchange trade or bombs, whether we compete in destruction or co-operate in the extension of human knowledge and the control of nature—including that dubious natural character man himself—the basic international problems of this generation will be faced, as for the most part they have been created, by the peoples of the North.

What the Aegean Sea was to classical antiquity, what the Mediterranean was to the Roman world, what the Atlantic Ocean was to the expanding Europe of Renaissance days, the Arctic Ocean is becoming to the world of aircraft and atomic power.

Relating the simple facts of physical and human geography to the political fears and tensions of this chilled and nervous world, it is not surprising that political and military experts are today looking with increasing frequency and increasing disquiet at the short air routes across the new narrow seas.

The revived interest in the Arctic, however, is not exclusively the result of political and military considerations. Increasing knowledge of the North has resulted in a new appreciation of the economic possibilities of that region. And the more admirable aspect of humanity's split personality is shown in a rapidly growing recognition of the social responsibility of those who enjoy a more favourable environment for the welfare of those of our common race who have been living in half-forgotten isolation beyond the horizon of the North.

If Canadians are to understand the significance of their own northern problems it is essential that they should know more than they commonly do about their Arctic and sub-Arctic regions. With the exception of Russia, Canada has the largest holding of Arctic territory. If we are to continue to retain this vast domain of land, sea and ice, we must prove that we are conscious of our stewardship.

The first need is knowledge.

Among Canadians who have had little opportunity to visit the Arctic or to study northern conditions there are two contrasting points of view that are widely held.

Of these the first might be described as the romantic. To those whose knowledge of the North has been derived chiefly from the cinema or from the lighter forms of fiction—









The Eskimos shown in the photographs above and bottom right are at an isolated camp on an island in the Gulf of Boothia.

Left:—
Arctic Red River, an Indian summer camping area in the Mackenzie River valley.

Bottom left:—
White fox pelts in the Hudson's Bay Company warehouse at Cambridge Bay.





whether or not disguised as journalism—Northern Canada is usually visualized as a region in which the midnight sun is the insignia of summer, and where northern lights brighten every wintry day; where red-coated Mounted Policemen travel swiftly behind racing teams of hardy Malemutes over spotless stretches of curving snow from one encampment of jolly and hospitable Eskimos to another; where life in igloo villages is a constant round of native dances, seal hunts and feasts of fish and blubber; where Hudson's Bay factors with Indian features and Scottish names keep the Union Jack flying over trading posts meticulously spruce, and where all the resources of the family or post are made available to welcome the unexpected stranger.

Others entertain a more dismal view of the North. To these the Arctic is a land of constant struggle and unremitting hardship; where in the Biblical phrase "the waters are hidden as with a stone and the face of the deep is frozen"; where darkness persists throughout the larger part of the year and unbearable cold is its invariable companion; where starvation is the common fate and disease indigenous to all; where every human resource is required to win the primary battle of survival and life is spent amid poverty, conflict, ignorance and filth; where, to adopt the words of Thomas Hobbes, the lot of man is "solitary, poor, nasty, brutish and short".

Truth can be drawn from elements in each of these stereotypes. As a result of experience, research and invention it is now known that human life in the Arctic, while conditioned by difficulties and privations which are not commonly experienced in more settled and more temperate regions, is by no means an impossibility for men and women of normal constitution. Nor is it necessary entirely to abandon those social and intellectual activities which are the proper requirements of the educated man or woman.

What are the facts about Northern Canada?

The Arctic and sub-Arctic regions of this country can be defined roughly as consisting of the Yukon Territory, the Northwest Territories including the Arctic Islands and their waters, the northern half of Quebec and Labrador, and that segment of the ice-capped polar sea that is caught within the Canadian sector.

In superficial area this territory includes some one and a half million square miles. It is divisible into four main sections; the Yukon Highlands, the Mackenzie Valley, the northern portions of the Canadian Shield and the Arctic Islands. Of these the most important in its potential contribution to the national economy is that great mass of ancient and weathered rock which, in the mineral zones of Ontario and Quebec, has added so immensely to Canadian wealth through its contributions of gold, silver, nickel, and other products of the mine. At Yellowknife the great Shield has already provided a basis for the largest settlement in the Canadian North. The barren and inhospitable surface of the Shield provides at once the greatest physical handicap to the development of settled communities and the greatest promise of riches upon which such communities can be established.

The climate of this area varies from the extreme winter temperatures of certain localities in the Yukon and in the northernmost islands to conditions that are quite as equable—to use a polite word—as those of such cities as Winnipeg and Ottawa.

Within this region there live today some 8,500 Eskimos and 6,000 Indians. For the most part they are to be found in nomadic or semi-nomadic groups with a cultural position that is a remarkable combination of neolithic and modern components. Here also are more than 14,000 men and women of the white race—if the ethnologists will forgive the employment of this inaccurate but useful term—most of them comparatively recent adventurers in the North.

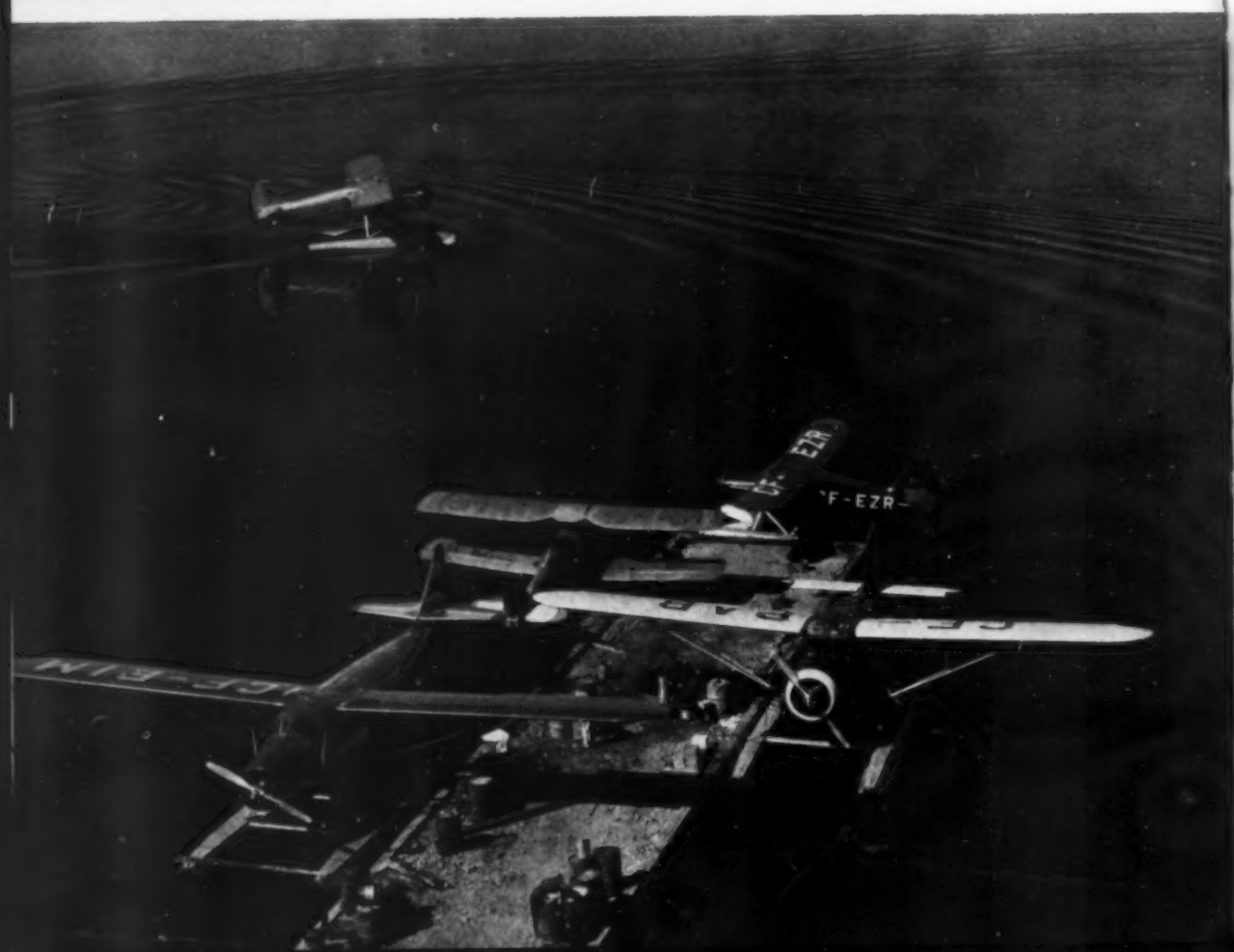
White settlement in Canada's far northern regions has been concentrated very largely in the Mackenzie District, mostly in the vicinity of Yellowknife, at various points in the Mackenzie River valley and in the Yukon Territory. In the Eastern Arctic



GREAT SLAVE LAKE

Left:—Fishermen bring their catches, which consist mainly of lake trout and whitefish, to the wharves at Gros Cap, about sixty miles south of Yellowknife.

Below: — Aircraft play an important part in the life of Yellowknife and the mines served by this northern community.



white settlement is negligible. Virtually the only white persons residing in this region are the representatives of the Royal Canadian Mounted Police, missionaries, medical staff, Department of Transport personnel, traders and employees of other Federal Government services.

So much for the area, population and climate. But what are the prospects of developing resources in northern Canada adequate to sustain a considerable population—to make a significant contribution to the economic welfare of Canada?

In a free and democratic country it is impossible to disregard the human element, in the planning of national projects, because of a desire to force the rapid development of a region that may or may not be able to provide a sound base for industry and population. In other words, Russia can employ its people as *expendable* factors in the gamble on northern development. Canada cannot. The U.S.S.R. has been able, through the use of compulsory labour, to establish a northern sea route along its Arctic shores and to build cities within the Arctic Circle. Canada will not use the same methods and it is possible that similar developments in this country will be long postponed.

This does not mean, however, that the Canadian North will forever remain a land of desolation, devoid of human activity. There is in the world today a constant and increasing demand for the kind of mineral wealth that is unquestionably to be found in the northern as well as in the southern reaches of the Precambrian Shield. It may well be that a slower development, based on a recognition of human rights and carried out with some regard to normal principles of economic practice, may in the end prove to be the most effective method of development. This is not to suggest, however, that we should not study the Russian experience or fail to learn from Russian results. But no gamble on the possibility of quick profits from the North is worth the sacrifice of the liberties of our people.

From the days of Henry Hudson to the end of World War I the economy of the North was based on fur, and the welfare of the inhabitants rose and fell with the supply and price of beaver, white fox, mink, marten and muskrat. In some areas of the North the age of fur still persists but elsewhere new foundations for the life of the region are being discovered.

Agriculture is a possibility in some parts of the Yukon and in the Mackenzie watershed, but it is likely that developments in this field will be confined to production for local use. There are few places on the continent that can produce better vegetables or berries than are to be found under the long summer sun of the Mackenzie valley or in the garden plots of Dawson and Whitehorse, but looking at the north as a whole, the percentage of arable land is not great. Grain crops can be more economically produced in the prairies to the south. The raising of cattle is likewise an expensive and doubtful project except for certain local and special needs.

In some parts of the North there are timber resources which it will one day be economic to exploit but, in general, this must wait, except for the satisfaction of local needs, on increased prices or a great reduction in the costs of transportation.

The possibility of fisheries on such a scale as to provide a new national asset is not to be disregarded. Already supplies of whitefish, lake trout and the succulent goldeye are being taken in commercial operations from the great northern lakes. Game fish also are found in numbers to satisfy the most ardent followers of Izaac Walton.

Attention should likewise be given to the possibility of further developing local handicraft industries in leather, wood, bone and other materials among the native population. The social as well as the economic values of such activities are of particular importance.

But the real development of the North will depend upon the discovery and development of mineral resources. The Yukon, having lain quiescent for nearly two generations, is experiencing a revival of mining. With cheap power in prospect and easier



An aerial view of the exciting town of Yellowknife on the north shore of Great Slave Lake. The old settlement is in the background and the new section in the foreground.



Mackenzie Highway, 46 miles south of Hay River townsite on the south shore of Great Slave Lake.

means of access being developed, the Trail of '98 may again become a road to achievement. Yellowknife, the most exciting town on the continent, is only awaiting the return of a reasonable price for gold as compared with other commodities, or a reduction in the costs of transportation, to develop into a city of considerable size. On the Labrador boundary there are iron deposits of exceptional quality and of an extent that must be measured in scores of miles. $200,000,000 are to be spent on their exploitation. Base metals on the shores of Great Slave Lake, copper in many places throughout the Territories, oil in the Mackenzie valley, all give promise of permanent development. Most significant of all, are the established radium and uranium deposits at Great Bear Lake, deposits which alone would have made Canada one of the most important of countries in the new atomic age.

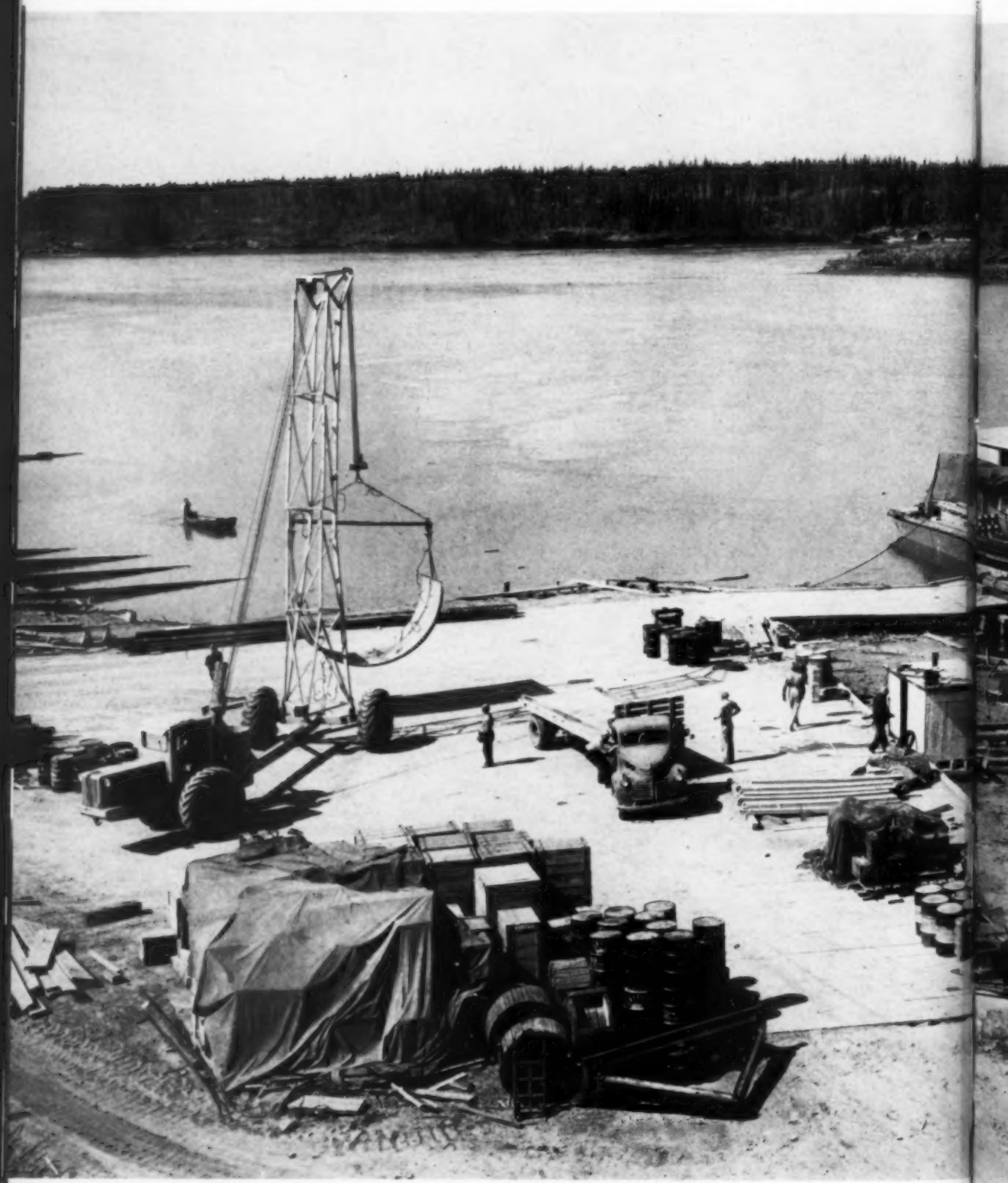
Apart from the discovery of resources, the fundamental problem of northern development is the problem of transportation. The whole history of the Canadian North can be divided into two periods—*before and after the aeroplane.* The northern mainland of Canada is a country well suited for service by air. Distances are enormous, the surface of rock, water and muskeg in summer, of snow and pressure-ridged ice in winter, makes surface travel slow and arduous. All this can be overcome by air travel. It is true that great difficulties must be overcome in establishing landing fields of a size to carry the largest commercial and military planes. But for the small plane equipped with pontoons in the summer and skis in winter, the Great Shield provides ideal conditions. There are few spots in the whole region in which it would not be possible for a plane, flying at five thousand feet, to find a safe landing—according to the season—on water or on ice. Recognizing this fact and aware of the mineral potentialities of the Shield, the early bush pilots of Canada made a fabulous record that placed this country in the forefront of commercial aviation. As a result of the work done in the northern bush and on isolated mail routes by such men as Dickins, May, Berry, Brintnell and Becker, Canada was for many years the first country in the world in the quantity of freight carried by air.

Today, scheduled airlines run from Edmonton into the Yukon and beyond, and from the same booming centre of air transport to Yellowknife and to the towns of the Mackenzie valley as far north as Aklavik. In addition, aircraft owned by individuals, corporations or the government are readily available at many posts in the Canadian North, and nowhere in that great expanse is there a spot that cannot be reached within a few hours flying. Yet it was less than a generation ago that even the simplest trip into our northern lands involved weeks of preparation and months of back-straining toil.

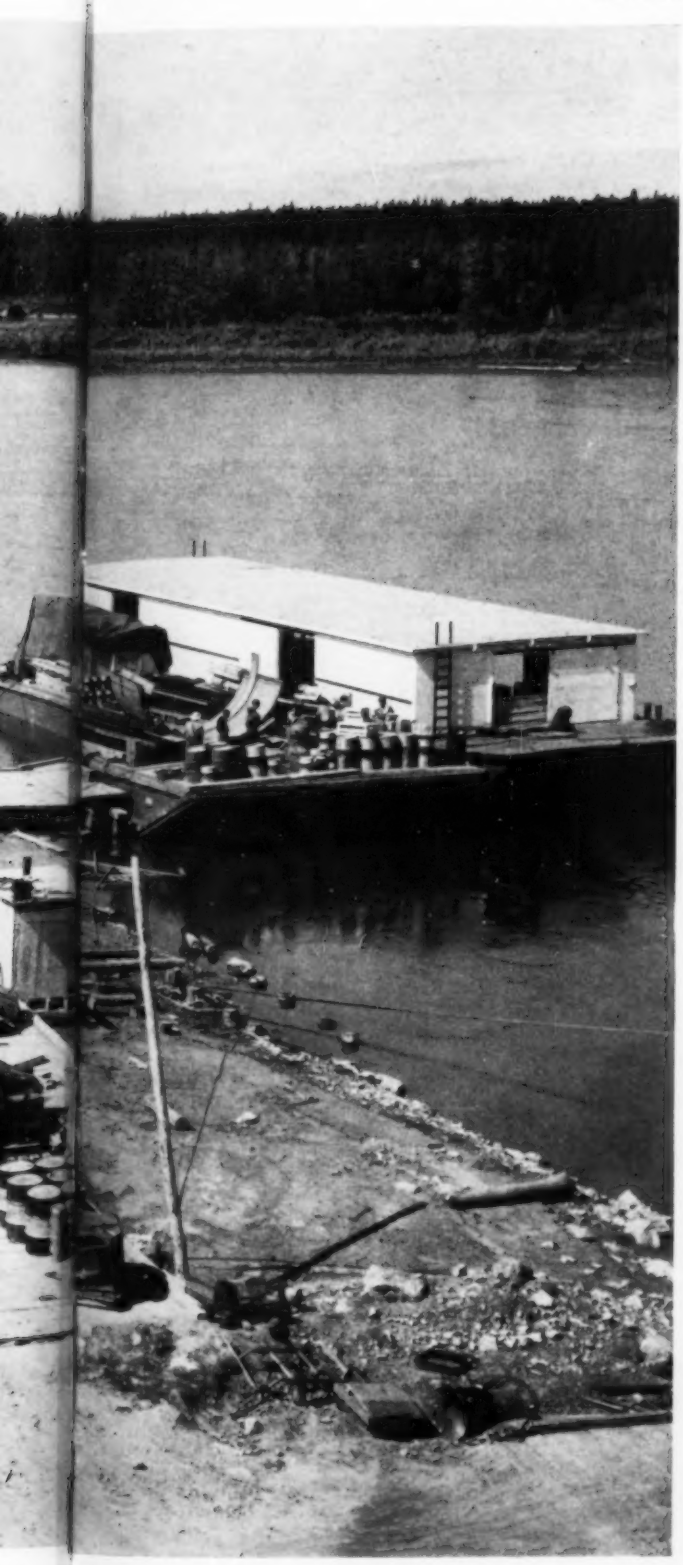
Other forms of arctic transport are being slowly but stubbornly developed. The Alaska Highway, constructed as a war measure, now joins together the airports of the northwest staging route and provides permanent land access to Alaska. The Atlin district, famous in the history of gold, is being linked to Whitehorse by road, and from legendary Dawson City and the Klondike another road is working south to Whitehorse, tying in on the way the mineral areas in the Mayo district. North from Alberta a highway now stretches over the tundra to Hay River, with a winter road providing ground access to Yellowknife. In addition, scientific study and experiment are pushing forward the development of more and more efficient types of snowmobiles —machines that will eventually supersede the Husky and the Samoyede as the motor car has supplanted the horse and mule.

By sea small vessels sailing out of Aklavik and Tuktoyaktuk service the weather stations and other scientific and trading posts that are spreading rapidly across the Arctic islands.

In 1950 a new vessel, constructed by the Government, will take the place of the wrecked *Nascopie* in carrying scientists, doctors, missionaries and administrators every year into the most isolated and barren areas of the eastern Arctic.



Fort Smith, on the Slave River, near the A[illegible]ndary on barges at Bell Rock shipyards, eight m[illegible] Fort posts on the Mackenzie River.



r the A ndary. Heavy equipment is loaded
ight m Fort Smith, for shipment to northern

If the base metal discoveries on Great Slave Lake develop as is now expected, a railway will within a few years reach the shores of that inland sea.

But the air will always remain the chief means of transport in the Canadian North.

It is the progress made in air travel and the recognition that the shortest routes between the major modern concentrations of human activity and power pass over Arctic lands and waters that have caused most of the dramatic and headline attention that has been focussed on the North in recent years.

During the war it is known that Canada and the United States worked together in the development of northern air supply routes, both to the United Kingdom and to Siberian Russia. The northwest staging route, the development of which was started by Canada before the war and completely paid for by this country, was the line along which thousands of aircraft were sent to reinforce the Russian front. Similarly, from the central and eastern parts of the continent bombing and fighting machines were flown to embattled Britain by way of Labrador and Greenland. Today these routes are for the most part still available for commercial travel. In addition, post-war planes can fly directly and non-stop across the roof of the world from Nanking to Ottawa or from Vancouver to Moscow. In the event of another war bombers will cross the ice caps, not the open seas.

That Canada and the United States are co-operating in providing for continental defences along the northern reaches of our land is, of course, well known. The Permanent Joint Board of Defence, established by Prime Minister Mackenzie King and President Roosevelt at Ogdensburg in 1940, has since that time, both in war and in the post-war period that we cannot yet call peace, been responsible for advising the governments of these two allied nations on common problems of defence in the North as well as on their ocean frontiers.

One point in connection with this defence collaboration should be repeatedly em-



Government ionospheric station at River Clyde, eastern Baffin Island, showing laboratory, dwelling, and storehouse.

Chipewyan Indians stock up with provisions in the Hudson's Bay Company post at Churchill, Manitoba.



phasized. In spite of charges made in other parts of the world and echoed in some circles in Canada, the principle of Canadian sovereignty over her own land and waters has not been placed in danger. Canada has more than paid her way in the contributions that she has made to the common problems of joint defence. Wherever military or semi-military establishments are set up on Canadian soil, they are under Canadian control. Whenever service exercises are undertaken on the lands or seas of this country, the final authority under which they are conducted is the authority of the Canadian people, expressed through our parliamentary institutions.

As international collaboration develops, it is possible that Canada may join with other nations in the relinquishment of an increasing measure of national sovereignty to some international authority. But this country has not surrendered and will not surrender the control of its territory or of its activities to any foreign state—no matter how friendly relations may be.

There has, however, been an altogether unhealthy emphasis placed on the military significance of recent developments in the Canadian North. It is undoubtedly true that Canada is doing whatever is necessary to provide for the exigencies of defence in that area, but far more significant for the long-term history of humanity on this continent is the work that is being done by the scientists, explorers, administrators, educators, missionaries, doctors and social workers who have been carrying the benefits, and occasionally and inadvertently the detriments, of our national way of life into the endless reaches of the North. These are the men and women who are working on our last frontier. It is they who will bring this harsh, stubborn and silent land into effective contact with the rest of Canada. It is through their intelligence and goodwill that the progress of our northern peoples toward integral union with other Canadians will be amicably effected. Here the old tradition that demanded extermination or forcible subjection of the native inhabitants by the conquering power is being translated into terms and practices less abhorrent to the humane and christian spirit. Amalgamation is inevitable, ruthless coercion is not.

Because little is known of the work that is being done by pioneer Canadians in Arctic regions, and because these pioneers will need others to assist and succeed them, it is worth placing briefly on record some of the important and stirring human events that are taking place along our northern horizon.

Fundamental in any record of developmental activities in the North is the work of our scientists and technicians. At the scientific research stations at Churchill and Baker Lake some of the most competent Canadian specialists are struggling with basic research problems in entomology, the mechanics of snow and ice, nutrition, archaeology, protection against cold, and many similar or related subjects. Weather stations have been established at strategic locations throughout the whole area and meteorological knowledge is rapidly expanding. Experts from the Dominion Observatory are working in the fields of geophysics and terrestrial magnetism. Geologists, topographers and geographers are exploring and recording the outer semblance and the hidden secrets of this stark and solemn land.

There is nothing exclusive about this scientific program. Indeed, nothing would give us greater satisfaction than to be able to co-ordinate our studies with those of other countries with similar problems to solve. Some progress in this direction has already been made in the exchange of knowledge and experience, particularly with the Danish administration of Greenland and with the scientists of the United States. In dealing with the North we should like in the words of the Honourable L. B. Pearson, to place the Canadian accent on "resources and research, not on strategy and politics".

In the North, as elsewhere, it is the human problem that is of the first importance. Scientific knowledge is significant only in so far as it contributes to human welfare.

It is quite clearly inevitable that the

The history of the Canadian North can be divided into two periods—before and after the aeroplane.

Eskimos at Cambridge Bay, Victoria Island. That the figure in front is a woman is indicated by the large triangular sleeves of her caribou blouse.

R.C.M.P.



Eskimos and northern Indians will eventually be brought into the Canadian community. In spite of the fact that in some respects they are only a short distance in habit removed from the Stone Age, it would now appear that the transition will not be as difficult nor as prolonged an operation as was once expected. The Eskimos, in particular, have shown an extraordinary facility in adaptation. Not only do they readily appropriate such modern tools as the Peterhead boat and the magazine rifle but they have shown themselves to be remarkably adept in learning to handle even such complicated mechanisms as the modern aircraft engine. (It is worth noting that during the war Russian Eskimos were among the most proficient aeroplane mechanics in the hard-pressed air force of our one-time ally). Eskimos and Indians alike are adopting the clothing of civilization, although this is not invariably either an aesthetic nor a practical advantage. They are turning even too rapidly to dependence on the food and technical equipment of the white trader. Nor have the customs associated with tobacco, alcohol, games of chance and even the radio been an unmixed blessing. It has sometimes been suggested that the Eskimos were the happiest people in the world until the advance of civilization brought them white flour, liquor, measles and radio commercials.

The real problem facing the Northwest Territories and Yukon Administrations in connection with the transition of the native peoples from their nomadic, hunting and essentially neolithic existence to a modern life consonant in most of its forms with that of the more settled parts of Canada is the necessity of controlling the change in such a way that the native peoples will not lose their natural virtues in acquiring the forms and advantages of modern life. The change must be gradual and voluntary. It must be conditioned by a recognition of the values that were developed in the more primitive forms of society. Its inevitability must not be accepted as justification for compulsion or for an unnecessary fracturing of native codes, customs and ideals. The suggestion that conventional Canadian marriage forms should be demanded of all Eskimos, for example, would, if imposed at this time, simply result in antagonizing the majority of those concerned and in creating unnecessarily a whole generation of illegitimate children.

These things are recognized by those who are charged with the official responsibility for the welfare of the native populations of Northern Canada.

First among the steps that are being taken to meet the needs of our Eskimo and Indian compatriots in the Northwest Territories and the Yukon is the provision of a more adequate medical service. Conditions among the northern nomads have always been harsh; the death rate has been high, particularly at birth; and the incidence of disease has been far beyond that experienced under more normal modern conditions. To the physical and mental problems which were inherent in native life, the white man has added new perils. Diseases against which the majority of Canadians have, over generations, developed a considerable power of resistance, find the northern natives without any comparable defence. Even the common cold, of which the average Eskimo is free in ordinary circumstances, strikes down whole communities following the visits of the annual Arctic patrols. In order to meet these new and old problems the Government is establishing or subsidizing small hospitals and nursing stations at many points throughout the North. Larger hospitals with facilities for long-term treatment, particularly of tuberculosis, have been set up near the



Doctor performing a spinal puncture operation on an Eskimo girl at Pangnirtung hospital, Baffin Island.



Classroom in the school at Fort Smith on the Slave River.

An Eskimo group in the store at Fort Chimo, northern Quebec, being issued with Family Allowances' goods. The trader is measuring out powdered milk while his wife assists by filling out the vouchers.



northern railheads. Complete X-ray examination of the whole of the native and white population of the North is under way, and vigorous efforts are being made to isolate those who are found to be suffering from tuberculosis.

With the attempts that are being made to provide for the health of our northern compatriots goes the development of an educational system that has no counterpart in previous Canadian history. Permanent schools are being established in most of even the smaller communities, and teachers with special qualifications in the field of welfare techniques are being appointed. It is the duty of these *welfare teachers* to develop the school as the vital centre of the community as a whole. It is used for meetings, for games, for social events, for health clinics, for the organization and activities of clubs, as well as for more conventional forms of instruction. Each school is provided with moving picture and film strip projectors, with a radio receiving set and with a gramophone. School programs are broadcast regularly to the Mackenzie valley area, and efforts are being made to duplicate this service in other parts of the North. In this activity members of the Royal Canadian Corps of Signals, working voluntarily, have made a most valuable contribution. Circulating film libraries are carried on a regular schedule from school to school, and records are supplied as part of the basic equipment of each of these community centres. The teachers who undertake this work are being enlisted as regular civil servants and work throughout the year (except for the normal three weeks' leave) instead of following the customary nine and a half months schedule of the Canadian public schools. The successful welfare teacher is the symbol of the new day in the Canadian North.

In dealing with the more nomadic groups, particularly in the Eastern Arctic, still other educational techniques must be developed and many experiments are in progress or under contemplation. Travelling schools, seasonal schools, combinations of teaching and nursing centres, and other innovations are being tried in order to meet the unique conditions of this area and of these people.

Canadian social services, such as family allowances, old age pensions and special assistance to the blind and helpless, have all been carried into the Arctic Circle. As a rule it is found to be impracticable to pay such allowances in cash and in such cases the recipients are permitted to take the payment in kind. Thus on occasion the family allowances of an Eskimo group may be consolidated for the purchase of a boat, an engine or some other item of equipment which can reasonably be expected to result in additional food or clothing for the children or the handicapped. The essence of the whole

Anglican mission buildings at Aklavik, near the mouth of the Mackenzie River. Left to right: church, hospital, teacher's residence and school.





Diamond drilling on a mining property near Yellowknife.

program is *flexibility*—the effort to adapt the methods to the essential purpose.

The North has been referred to as the frontier. But the frontier is more than a geographical area; it is a way of life, a habit of mind. As such, it plays a most significant role in the national life. The influence of the frontier on the intellectual, social, economic and political history of the United States has been a major theme in the historical records of that country. But the frontier in the United States disappeared about the year 1890.

This climax has not yet occurred in Canada. But whereas the frontier in American territory was a phenomenon of the West and its last stand in that country was staged in the mountain states, in Canada the frontier has persisted longest in the North. Here indeed is a true frontier and one that will never be fully conquered.

This is a matter of vital importance to the future of Canada. The virtues peculiar to frontier conditions—social and political democracy, independence and self-reliance, freedom in co-operation, hospitality and social responsibility—are virtues of particular importance in national life.

Perhaps it is here that the greatest contribution will be made by the Canadian North. Much as that area may contribute to the economic life of the country, this contribution may be of less significance than the fact that here will be a permanent source of energy from which Canada will draw strength in the never-ending fight to guard and maintain the personal and human rights of her people. As long as the frontier remains there will be Canadians who will never succumb to the dogmas of the totalitarian or the power of domestic tyranny. The frontier is a bastion of freedom, and the North is a permanent frontier.

Canals in Cradle and Grave

by VINTON MADER

MOST CANADIANS know that by its St. Lawrence River and Great Lakes canals their country has developed the world's greatest inland navigation system and they have been following with interest the current plans between Canada and the United States for an International Seaway. But if few are ignorant of the central canal system, equally few know that the Maritime Provinces have had a long, if none too happy, experience with artificial waterways.

From the middle of the nineteenth century the mainland of Nova Scotia has been cut in half by an ill-fated and forgotten canal and the Island of Cape Breton has also been divided into two parts. Familiar to more, but still not widely known, are the many plans and proposals to cut Nova Scotia off from New Brunswick at the isthmus of Chignecto, a bare twenty miles of marshland between the Gulf of St. Lawrence and the Bay of Fundy.

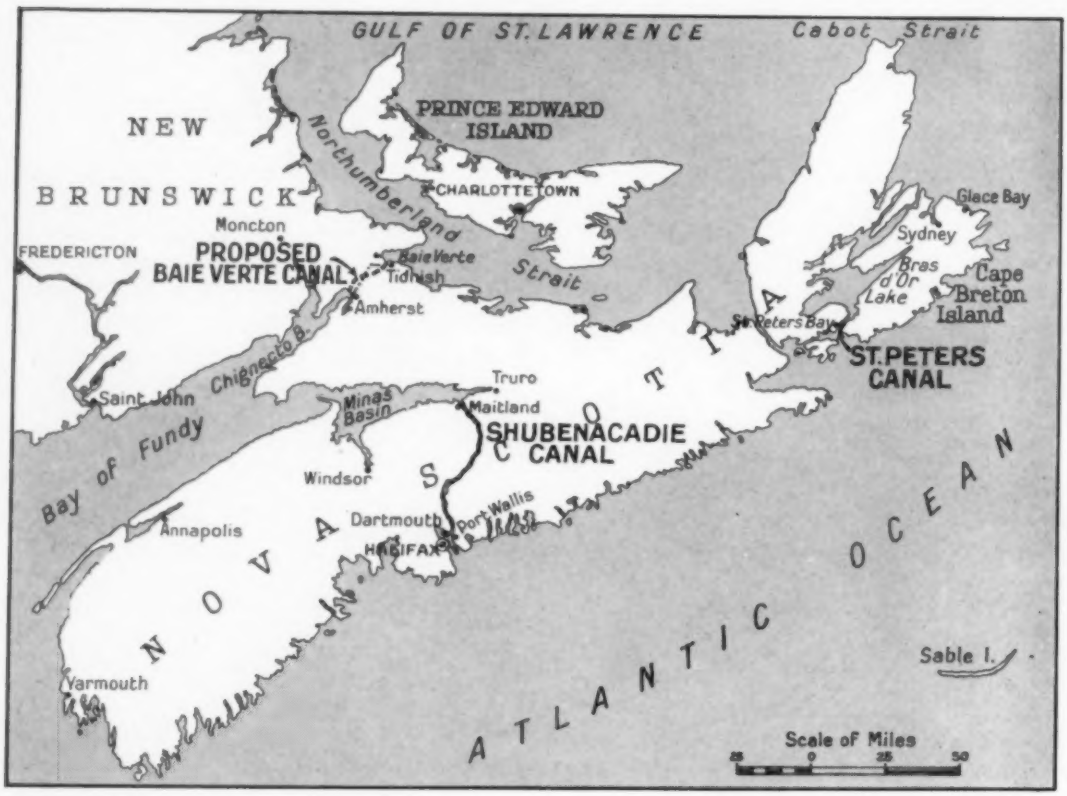
The dream of the Chignecto or, as it is called after the bay into which its northeast end would run, Baie Verte Canal is doubtless the oldest of these three enterprises. A report upon the isthmus made by de Meulles, the Intendant of Canada, in 1686, over two and a half centuries ago, says Chignecto "may be easily cut through by a canal, since all the land there is very low. In this case communication would be made between the French Bay (Chignecto Bay) and the Straits of St. Lawrence (Northumberland Strait), which would shorten the way from Quebec to Port Royal (Annapolis) by at least two hundred leagues (600 miles)". Thus, the thought that occurs when one looks at a map of the Maritime Provinces had been entertained as a project in the earliest days of the French colonies.

In the early days communication in the Maritimes was almost entirely by coastwise shipping and vessels were at the mercy of the weather. The idea of a shorter and safer route than the hazardous ocean one around Nova Scotia prompted the Maritime governments, with the government of the Province of Canada included once, to conduct four enquiries into the possibilities of a Baie Verte Canal between 1822 and the time of Confederation. The Province of Nova Scotia went so far as to charter a short-lived private company to undertake construction.

Francis Hall, a civil engineer, had just made an exhaustive report to the New Brunswick government when Thomas Chandler Haliburton, more famous as Sam Slick, was writing his book, *An Historical and Statistical Account of Nova Scotia.* In the book Haliburton transcribes Hall's full report, complete with a map, and adds: "By the construction of this canal, the long and dangerous circuit of Cape Breton in the navigation between New-Brunswick and the St. Lawrence, will be avoided . . . The exports of both Provinces to the West Indies are very extensive, and as a drawback of duties is allowed on the transportation of Rum, from New-Brunswick and Nova-Scotia, to Canada, it will create a vast increase in the inter-colonial trade".

Whether led by the smell of Maritime rum or not, since the Dominion of Canada was created the Federal government has conducted no less than eight further enquiries into the Baie Verte Canal project. Sir John A. Macdonald's government even extended a subsidy of $150,000 a year for twenty-five years to a New Brunswick company engaged in the grandiose scheme of building a ship railway to carry vessels of 1,000 tons across the isthmus. That project failed financially and has left nothing but massive stoneworks and a story that the engineer who planned it was buried, at his own request, at the Fundy end of his hapless undertaking, after dying from a broken heart.

Photographs by courtesy of Nova Scotia Bureau of Information except where otherwise credited.





The bridge near the Tidnish end of the abandoned Chignecto ship railway as it looks today and (inset) as it appeared in a nineteenth century photograph.





Ships' cradle of the docks of the old Chignecto ship railway near Amherst while under construction in the 1880's.

All the earlier examiners had no hesitation in recommending that something be done to connect the waters which were so close and yet so divided. But as ships grew in size and speed the hearts of Royal Commissioners began to harden against the Baie Verte Canal. The latest Commission to investigate it was appointed in 1931, and the best it could accord was—"feasible".

Its report said: "This Commission is strongly of opinion that the proposal to construct a canal at Chignecto offers no national or local advantages at all commensurate with the estimated outlay". The report cited the difficulties of overcoming Fundy's famous tides, which sometimes range sixty feet between low and high, and the nullification of any saving in distance by the time loss in working a ship through the canal. It concluded that even if sufficient trade were offered, the canal could do nothing but progressively lose money while working to capacity. Though the report was not printed till 1939 and few copies of it exist, it has once again sent the Baie Verte Canal to the Valhalla where so much of Maritime sea-lore lives in glory.

But never be too sure it has had its final entombment! One day, again, some member of Parliament from the provinces by the sea may rise in the House of Commons. With fire in his eye he may demand to know if the government realizes that the marshes of Chignecto are an open invitation to canalization—and the Baie Verte Canal will be alive again.

Undertaken with more determination, but doomed to a sudden and hopeless end, was the Shubenacadie Canal, whose story runs through the history of Nova Scotia for more than a hundred and fifty years. First definite mention of it was made in a letter



St. Peters Canal, Cape Breton, half-mile-long waterway b[illegible]tlantic tidal lock in Canada (picture on extreme left). Centre p[illegible]the hi[illegible]

which Sir John Wentworth, Lieutenant-Governor of Nova Scotia 1792-1808, wrote to an army officer in the interior of the province on May 27, 1794. He told the officer his territory would be much improved "by *my plan* of rendering the Shubenacadie (River) navigable, and a communication thence to Dartmouth by a chain of lakes".

Though in 1797 the government voted £250 "to procure a survey of a canal from the basin of Minas to the harbour of Halifax by the Shubenacadie route", no work was undertaken until more than a decade after the War of 1812. Then the Shubenacadie Canal Company was chartered and the government voted £15,000 to aid it, but wisely stipulated that the money be doled out by instalments as the work showed progress.

Ground was broken on the Dartmouth side of Halifax harbour by Lord Dalhousie, the retired Lieutenant-Governor, on July 24, 1826. Addressing a gathering which included British officers, Masonic Lodges and his successor, Sir James Kempt, he said: "Persevering inquiry has now overcome all doubts of the practicability of the work, and the spirit of enterprise and improvement has contributed funds on which to make a beginning".

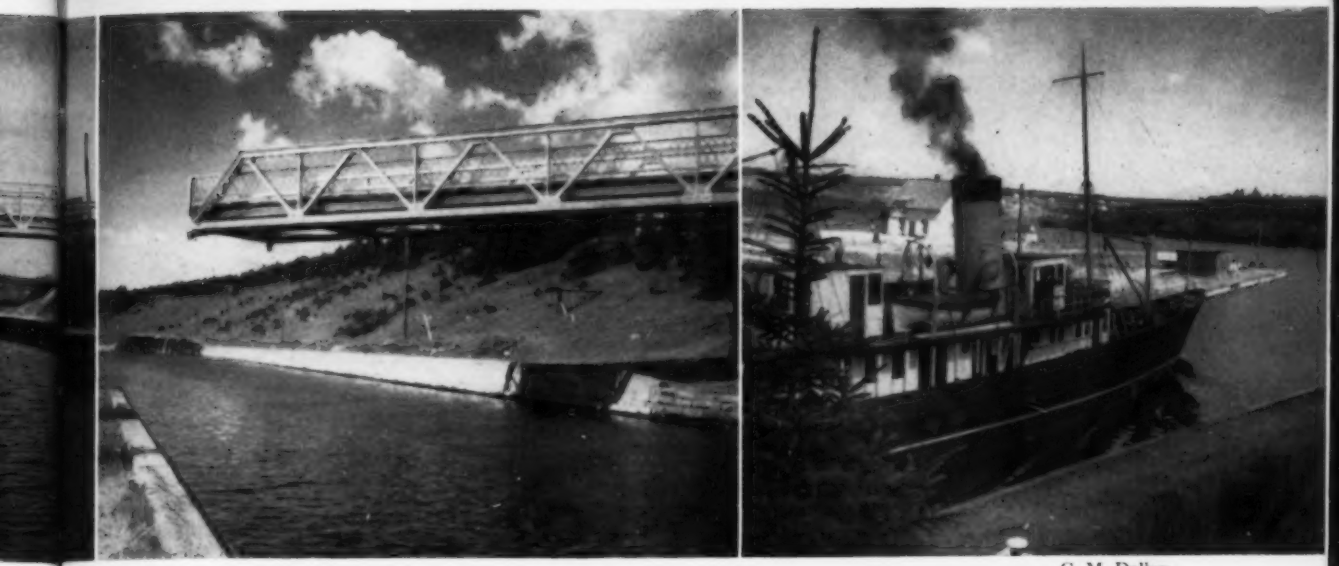
Construction was pursued vigorously. Skilled stonecutters were imported from Scotland, capital was recruited by selling company stock in England and a loan was secured from the British Lords Commissioners of the Treasury. But enthusiasm did not justify the optimism with which Lord Dalhousie had swung his pick.

Misfortune befell it from the beginning. Unexpected frosts damaged the workings, a dam burst on one of the seven lakes in the closely-connected chain and washed out what had been done on two others. Finally, faults in the engineering appeared and miscalculations with regard to the Fundy tides threw the whole plan into disrepute.

When the company trembled on the brink of bankruptcy, the British government foreclosed its mortgage. The provincial government acquired ownership of the whole property and held it dormant for many years. Then a new company, Inland Navigation, was formed. It purchased the property from the government and slowly pushed construction until in 1861 the job was done and the province traversed by a navigable waterway.

The first vessel to make the complete trip was a 60-ton steamship, triumphantly named *Avery* for the president of the company. She made a return trip between Halifax harbour and Maitland, at the mouth of the Shubenacadie River.

Fireside tales of the 'olden days', weaving romance by accent on its tragedy, maintain



G. M. Dallyn

tlantic Ocean and Bras d'Or Lake. It contains the only the highway swing bridge at the lake end of the canal.

that one ship was sent through the Shubenacadie Canal and then it was closed. However, the failure was not as bad as that. Truly, its end was in sight almost before its opening; for three years before it was opened the railroad from Halifax to the Fundy port of Windsor had been completed. But the records show that the Shubenacadie Canal was operated for about ten years. It carried lumber and building materials, firewood and coal and did a carrying trade with the inland gold mines. For part of its active history it is even said to have shown a modest profit!

The railroads spelled its doom in other ways than by economic rivalry. In 1870 the owner engaged in a court action with the Mines Department over gold discoveries that had been made on his properties. He was awarded $1,000 damages in a trespassing suit, but soon he found that low railroad bridges were being thrown across his canal and drawbridges were being replaced by fixed ones. Probably by then he was satisfied to take his thousand dollars and abandon the canal business.

With the years the Shubenacadie Canal has slipped deeper and deeper into anonymity. The closer the trees grow around it the more it is forgotten. At this time many people living within a stone's throw of the old waterway know nothing of its story. The only vessel passing through it now is the canoe of an occasional enthusiast from Dartmouth who takes the pleasure trip which, with a few short portages, can be made across the province.

The final canal with which the Maritimes have been concerned is the little St. Peters Canal of Cape Breton. Its length is about 2,640 feet but, tiny as it is, it occupies the only bright spot in the Maritimes' unhappy relations with canals.

In the Department of Transport's book, *The Canals of Canada*, this little half-mile cut proudly challenges the vast and bustling canals of central Canada as a complete, self-contained canal system. Its impressive title is "Atlantic Ocean to Bras d'Or Lakes Route".

It holds a proud place in other ways, too. Despite the elaborate ice-breaking methods used on the Great Lakes system, it still holds the record as the Canadian canal with the longest open season, surpassing even the mighty Welland Ship Canal in that respect. In the past six navigation seasons the Welland has been open longer than the St. Peters only twice, and the little Cape Breton ditch has averaged 265.3 days per season to the Welland's 258.3.

To recount a few more of its distinctions, it has a tidal lock (which raises and lowers ships by a flow from the end that has the

higher water) and is the only Canadian canal with one. Though it may be small in length, in draught it is no midget. It bows only to the Welland Ship Canal and the Sault Ste. Marie Canal; and when the tide is high in St. Peters Bay it is a fathom deeper than the Sault and falls short of the giant Welland by only five feet.

The location of the St. Peters Canal is through the narrow isthmus between the two sides of Cape Breton Island. As a canal it does not go so far back into the history of the Maritimes as do the Baie Verte and Shubenacadie projects. But back to the dim reaches of time go stories that Micmac Indians portaged their canoes over the canal route when travelling between the Bras d'Or and the outer coastal waters. In the early days of white settlement boats were hauled across by placing them on skids and using ox teams for power.

The forgotten locks at Port Wallis, a few miles from Halifax, on Nova Scotia's old Shubenacadie Canal.



The canal was proposed to the Nova Scotia government after Cape Breton was united politically with the mainland in 1820. In 1825, the same year as he reported to the New Brunswick government on the Baie Verte Canal, Francis Hall, the engineer, surveyed St. Peters for Nova Scotia and estimated that a canal could be cut for £17,500.

Not until 1854 was construction undertaken, and two years later it was suspended by reason of financial difficulties till 1865. The canal was completed under the Federal government and opened on August 13, 1869. Since then it has been enlarged twice, its total cost being $1,700,000. But it operates cheaply and the Department of Transport is well content to keep it in action.

The Bras d'Or Lakes being in reality not lakes, but a landlocked arm of the sea—the arm of gold—with a narrow opening into Cabot Strait to the north, trade through St. Peters is mostly in small vessels seeking a protected passage to and from the port of Sydney. Its chief business is in oil and coal, and it normally carries twice as much cargo up (to the north) as it does down.

Its total carriage in an average season is about 50,000 tons, but during World War II it proved particularly valuable in sheltering small craft from the submarine menace. Its carriage was increased fourfold, reaching 288,143 tons in 1943, and under pressure of coal from Sydney the direction of its trade was reversed.

Though not by any means a vital part of Canada's inland navigation, compared with the Baie Verte and Shubenacadie undertakings the St. Peters Canal is an unqualified success. It will go its quiet way for many years to come, a sturdy infant that saves Maritime Canals from complete failure.

JOURNAL ARTICLES ON THE CANADIAN NORTH

For the convenience of those interested in more extensive information on the Arctic and Subarctic, we provide a list of some of the articles published in the Journal on this subject during the past several years:—

Arctic Wild Flowers by A. E. Porsild, May 1930.

With the Arctic Patrol by Dr. F. G. Banting, May 1930.

Adventuring in Baffin Island by J. Dewey Soper, July 1930.

The Franklin Search by L. T. Burwash, November 1930.

Searching the Arctic by Aeroplane by G. H. Blanchet, December 1930.

On the Rat River, Northwest Territories by C. C. Rogers, January 1931.

The Gravel River Indians by Frank Ebbutt, April 1931.

In Polar Lands by Sir Hubert Wilkins, June 1931.

Flying Along the Mackenzie by T. Wayling, May 1932.

The Yukon and Her Flowers by Mrs. G. Black, January 1933.

An Arctic Sled Journey by Richard Finnie, February 1933.

"Down North" to Great Bear Lake by Allen Bill, May 1933.

Solitudes of the Arctic (Baffin Land) by J. Dewey Soper, September 1933.

Eight Hundred Miles on the Yukon by W. K. Gibb, March 1934.

Old Trails to the Arctic by P. H. Godsell, April 1934.

In the Land of the Musk-Ox by G. H. Blanchet, June 1934.

The Mounties in the Arctic by Maj.-Gen. J. H. MacBrien, April 1935.

Mapping the Arctic by F. H. Peters, January 1936.

Vagabonding in the Arctic by T. H. Inkster, February 1936.

Flying Through Northwest Canada by Charles Camsell, March 1936.

South Nahanni River, Northwest Territories, by Alan E. Cameron, May 1936.

Feathered Pioneers of the Canadian Northwest by Hamilton M. Laing, May 1936.

The Copper Eskimos of Coronation Gulf by C. H. Dodwell, June 1936.

Canada's Northernmost Island (Ellesmere Is.) by W. Eggleston, September 1936.

Modern Pioneering in Canada's Western Sub-Arctic by R. Finnie, September 1936.

An Eleven Thousand Mile Inspection Trip by Sir J. MacBrien, November 1936.

Eskimo Exodus by T. Wayling, January 1937.

Great Bear Lake—An Exploration and its Sequel by Charles Camsell, March 1937.

North to the Yukon by Air by J. Fergus Grant, August 1937.

Exploring Upper Nahanni River and Snyder Mountains by Harry Snyder, October 1937.

The Golden North, Labrador and North Shore by Leo Cox, April 1938.

The Annual Eastern Arctic Patrol by D. L. McKeand, July 1938.

Spectacular Frobisher Bay by Martin J. Buerger, July 1938.

Conquest of Mount Lucania by Bradford Washburn, October 1938.

The Yellowknife Mining District by Charles Camsell, June 1939.

New Wings for the Yukon Mail by J. Harper Prowse, December 1939.

Canada's Eastern Arctic Patrol by R. S. Marriott, March 1940.

My Home Town—Fort Liard by Charles Camsell, September 1940.

A Road to Alaska by L. J. Burpee, November 1940.

Canada Moves North by Richard Finnie, November 1941.

Southampton Island by T. H. Manning, January 1942.

The Coastal District of the Eastern Barren Grounds and Melville Peninsula by T. H. Manning, February 1943.

Northwest Passage by Air by J. A. Wilson, March 1943.

Canada's Northern Air Routes by D. B. Wallace, October 1943.

The "Canol" Project by O. B. Hopkins, November 1943.

Planning the New Northwest by Charles Camsell, December 1943.

Alaska Highway by S. C. Ells, March 1944.

Agricultural Lands in the Canadian Northwest by E. S. Archibald, July 1944.

Mineral Resources and Mining Activity in the Canadian Eastern Arctic by J. L. Robinson, August 1944.

Eskimo Population in the Canadian Eastern Arctic by J. L. Robinson, September 1944.

Economic Wild Life of Canada's Eastern Arctic (Caribou) by J. G. Wright, October 1944.

Fur Rehabilitation in Northern Manitoba by D. M. Stephens, January 1945.

Conquest of the Northwest Passage by R.C.M.P. Schooner St. Roch by J. L. Robinson, February 1945.

A Brief History of Exploration and Research in the Canadian Eastern Arctic by P. D. Baird and J. L. Robinson, March 1945.

Land Use Possibilities in Mackenzie District, N.W.T. by J. L. Robinson, July 1945.

Agriculture and Forests of the Yukon Territory by J. L. Robinson, August 1945.

Plant Life of the Churchill District by Eva Beckett, August 1945.

Water Transportation in the Canadian Northwest by J. L. Robinson, November 1945.

Fur Production in the Northwest Territories by M. J. and J. L. Robinson, January 1946.

Weather and Climate of the Northwest Territories by J. L. Robinson, March 1946.

Exploration and Settlement of Mackenzie District by M. J. and J. L. Robinson, June and July 1946.

The New North by Charles Camsell, December 1946.

Epic of Canol by Richard Finnie, March 1947.

North on the Hudson Bay Railway by Lyn Harrington, August 1947.

Old Crow's Village (Yukon) by Douglas Leechman, July 1948.

Mistassini Territory of Northern Quebec by J. M. Neilson, October 1948.

Surveying on the Hamilton River, Labrador, by G. H. Desbarats, November 1948.

Canada's Western Arctic by J. L. Robinson, December 1948.

Tractor Trails in Manitoba by Lyn Harrington, February 1949.

Churchill, Manitoba, by M. Y. Williams, September 1949.

THE CANADIAN GEOGRAPHICAL SOCIETY

OTTAWA, CANADA

HONORARY PATRON

His Excellency Field-Marshal the Right Honourable Viscount Alexander of Tunis, K.G., G.C.B., G.C.M.G., C.S.I., D.S.O., LL.D., M.C., A.D.C.

HONORARY PRESIDENTS

CHARLES CAMSELL, C.M.G., LL.D., B.A.
and J. B. TYRRELL, M.A., LL.D., F.G.S.

BOARD OF DIRECTORS

CHARLES G. COWAN, President
Hon. W. A. BUCHANAN, Vice-President
Gen. A. G. L. McNAUGHTON, Vice-President
R. C. WALLACE, Vice-President
J. A. WILSON, Vice-President
K. G. CHIPMAN, Honorary Treasurer
E. S. MARTINDALE, Honorary Secretary
Hon. A. E. ARSENAULT, Charlottetown, P.E.I.
MARIUS BARBEAU, Ottawa
ARTHUR BEAUCHESNE, Ottawa
G. GORDON BELL, Ottawa
Col. A. F. DUGUID, Ottawa
Maj.-Gen. W. W. FOSTER, Victoria, B.C.
AUGUSTIN FRIGON, General Manager, Canadian Broadcasting Corporation, Ottawa
K. A. GREENE, Ottawa
H. L. KEENLEYSIDE, Deputy Minister, Department of Mines and Resources, Ottawa
GILBERT LaBINE, Toronto, Ont.
F. C. C. LYNCH, Ottawa
B. R. MacKAY, Department of Mines and Resources, Ottawa
C. J. MACKENZIE, President of National Research Council, Ottawa
M. W. MACKENZIE, Deputy Minister, Department of Trade and Commerce, Ottawa
T. H. MANNING, Ottawa
Lt-Col. L. T. MARTIN, Ottawa
Lt-Col. SIDNEY C. OLAND, Halifax, N.S.
F. H. PETERS, Aylmer, Quebec
E. J. TARR, Winnipeg, Man.
GRIFFITH TAYLOR, University of Toronto, Toronto, Ont.
Hon. T. VIEN, Montreal, Quebec
J. C. WEBSTER, Shediac, N.B.
J. T. WILSON, University of Toronto, Toronto, Ont.

Honorary Counsel: H. ALDOUS AYLEN, K.C.

Editorial Committee

R. J. C. STEAD, Ottawa, Chairman
MALVINA BOLUS, Secretary
F. J. ALCOCK, Ottawa
G. C. ANDREW, Vancouver
Hon. A. E. ARSENAULT, Charlottetown
GEORGE W. BROWN, Toronto
D. W. BUCHANAN, Ottawa
Hon. W. A. BUCHANAN, Lethbridge
G. M. DALLYN, Ottawa
W. EGGLESTON, Ottawa
D. C. HARVEY, Halifax — H. A. INNIS, Toronto
GEORGE H. T. KIMBLE, Montreal
M. E. LaZERTE, Edmonton
F. C. C. LYNCH, Ottawa
R. O. MacFARLANE, Winnipeg
I. S. McARTHUR, Ottawa
S. F. RAE, London, England — J. E. ROBBINS, Ottawa
R. J. C. STEAD, Ottawa
H. L. TRUEMAN, Ottawa — J. C. WEBSTER, Shediac
M. Y. WILLIAMS, Vancouver

Executive-Secretary and Editor of Publications

GORDON M. DALLYN

Auditors: Davis, Bishop & Company, Chartered Accountants

EDITOR'S NOTE-BOOK

Edward M. Holbrook was born in Sarnia, Ontario. From his earliest years he came under the influence of the oil industry, his father being an oil company official, and the first seven years of Mr. Holbrook's life being spent in the oil districts of Peru. He returned to Toronto where he attended school and then went to the University of Birmingham, England, where he graduated with the degree of B.Sc. in Petroleum Engineering. On his return to Canada in 1937 Mr. Holbrook joined the Imperial Oil Company, with whom he is still associated, now living in Toronto. He is a member of the Association of Professional Engineers of Ontario and an associate member of the Chemical Institute of Canada.

* * *

Harriet Geithmann is a native of Wisconsin. She is a free-lance writer who travels extensively and contributes to numerous periodicals.

* *

Hugh L. Keenleyside was born in Toronto but shortly after was taken to Vancouver, where he grew up. He graduated from the University of British Columbia, then studied at Clark University where he received his M.A. and Ph.D. During the following two years Dr. Keenleyside lectured in History in the United States and at the University of British Columbia. In 1928 he entered the Department of External Affairs and the

EMBLEM OF EXCELLENCE — IN FINE PRINTING PAPERS

This monogram identifies the products of 40 years of leadership, experience and research. It means supreme quality and top performance. Specify "Provincial"—and make sure your next delivery of fine papers comes guaranteed by this proud label.

Provincial Paper Limited

388 UNIVERSITY AVE., TORONTO 2, ONT.
PHONE ADelaide 1986

CANADA CEMENT BUILDING, MONTREAL 2, QUE.
PHONE MArquette 1129



When in
MONTREAL

Men of affairs naturally stop at The Windsor because of its convenient location and its well-established reputation for courtesy comfort and service.

The Windsor is recognized as the proper place for business and social meetings.

THE Windsor
ON DOMINION SQUARE

J. ALDERIC RAYMOND
PRESIDENT



following year he was sent to Tokyo where he opened the Canadian Legation and remained for seven years. On his return to Canada he served on several international councils and commissions, including the Canada-United States Joint Board on Defence, the War Technical and Scientific Development Committee, and the Northwest Territories Council. Dr. Keenleyside was appointed Ambassador to Mexico in 1944, which position he relinquished in 1947 when he was appointed Deputy Minister of Mines and Resources and Commissioner of the Northwest Territories. In addition to being a member of various official bodies Dr. Keenleyside is a member of the Royal Historical Society and the Royal Geographical Society of Great Britain; he was a founder and is a Governor of the Arctic Institute of North America and is a Director of The Canadian Geographical Society.

* * *

Vinton Mader is a young Ottawa writer who graduated from Ottawa's Carleton College in Journalism.

THE
CANADIAN GEOGRAPHICAL
JOURNAL

is produced by

GAZETTE PRINTING
COMPANY LIMITED

Specialists in

DESIGN & TYPOGRAPHY
FINE COLOUR PRINTING
OFFSET LITHOGRAPHY
COLOUR PHOTO-ENGRAVING
DE LUXE BINDINGS

★

1000 ST. ANTOINE STREET, MONTREAL
HArbour 2241



VACATIONS ARE FUN—
Western Style

Pack up your duds and head out West to friendly British Columbia. Here you'll enjoy everything that's best in a Western vacation. Superb horseback riding, exciting fishing for cut-throat trout and world famous salmon, all against magnificent natural settings. A hundred different resting places tempt you to admire unspoiled majestic views from every highway. Come any time. The climate's always cool and refreshing . . . our Western welcome always ready. For full details, write: British Columbia Government Travel Bureau, Victoria, B.C.

M-23-49



What's ahead...



...for him

Every father dreams of giving his son the advantages he, himself, may have missed. High school, certainly . . . university, perhaps . . . and afterwards the sort of start that ensures his not having to take the first dead-end job that comes along. But these things take money—and how can you be sure it will be available when most needed?

There is a Mutual Life of Canada plan that enables you to safeguard your child's future now. Consult our local representative. Explain your circumstances and desires to him and let him tell you how this special Mutual plan will give him his right educational start and financially assist him in future years, as well.

Protection at Low Cost

THE
MUTUAL LIFE
of CANADA

HEAD OFFICE — 80th YEAR — WATERLOO ONT.

MM-298